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GEOLOGICAL SURVEY OF PENNSYLVANIA.

SEVENTH REPORT

ON THE

OIL AND GAS FIELDS

OF

WESTERN PENNSYLVANIA.

FOR 1887, 1888.

[Following the Annual Reports of 1885 and 1886.)

WITH ADDITIONAL UNPUBLISHED WELL RECORDS.

BY

JOHN F. CARLL.

Illustrated by

1. A GENERAL MAP OF THE WHOLE OIL AND GAS REGION;
2. AN UNDERGROUND MAP OF THE CORNIFEROUS LIMESTONE (VIII A);
3. AN UNDERGROUND MAP OF THE RED BEDS;
4. A COLUMNAR SECTION OF THE FORMATIONS FROM VIII TO XVII;
5. A VERTICAL SECTION OF THE VENANGO-BUTLER OIL GROUP; AND
6. CHARTS OF PRODUCTION, SHIPMENTS AND STOCKS.

HARRISBURG:
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1890.

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LETTER OF TRANSMITTAL.

To His Excellency, Governor BEAVER, *ex-officio Chairman of the Board of Commissioners of the Geological Survey of Pennsylvania:*

SIR:—I have the honor to submit Mr. John F. Carll's last Report on the progress and condition of the Oil and Gas Region of the State, during the years 1887 and 1888, made to me June 1, 1889, the publication of which has been delayed by causes for which I am not responsible, as the Board is fully aware. Demands for this report have been incessant from the citizens of western Pennsylvania, showing how much such knowledge is needed and valued. In especial the revised General Map of the whole region, including adjoining strips of New York, Ohio and West Virginia, has been called for by almost every mail since it was made known that such a map was to accompany the report—a map which shows all the known oil and gas pools areas, with limits enlarged by the experimental borings of the last three years.

Although this report is lettered I,5. because it is published, like each of the first four, in a separate volume of the series, it is in reality Mr. Carll's *Seventh Report* on the progress of his survey of the Oil and Gas regions of the State. His Fifth and Sixth are to be found included in the Annual Reports of 1885 and 1886.

Most readers will be chiefly interested in the statistical tables and charts of this report, demonstrating the continued decline of production.

A well selected addition to the number of published well records is made in this report.

Our knowledge of the Oil-Gas rocks is materially enlarged by new facts obtained and elaborated by Mr. Carll; such as the increased thickness of the *Venango-Butler oil sand group* southward into West Virginia, and southeastward into Westmoreland county; the non-identity of the

Big Injun sand of Washington with the older and lower *Big Injun* sand of the West Virginia state line; the identity of the latter with the *Pocono sandstone formation;* the notable change in the character of the *Oil Sand group* to a general shale formation in going from western Allegheny county eastward into Westmoreland, and the consequent improbability of the extension of good productive ground in that direction. These and other important facts Mr. Carll states clearly, and makes practical deductions from them which oil and gas men will find useful.

The theory of *hydrostatic pressure*, so much insisted on by the geologists of Ohio and Indiana, to explain the gas-pressure of their wells sunk to the Trenton limestone, receives no support from Mr. Carll's investigations. On the contrary, cogent facts and reasons against it are presented by Mr. Carll.

A discussion of the theory will be found in the Annual Report of 1885, pages 657 to 666. It seems to me that the facts and arguments there presented are supported by the facts in this report of Mr. Carll.

In the case of the "Trenton" gas field of western Ohio and eastern Indiana I cannot conceive it possible that a hydraulic pressure-head at the Trenton outcrop in Canada can account for the well-pressure one or two hundred miles to the south of it. If friction in a pipe-line reduces gas pressure say 7 lbs. per mile (An. Rt., 1885, p. 665) friction in porous magnesian lime strata must do more than that; and the heaviest gas well mouth pressures reported would be used up by friction through any oil or gas rock we know of in much less than 100 miles, even under the most favorable circumstances for unrestricted flow that could be imagined. Considering all the local underground obstacles to free flow, I cannot think that even the highest gas pressure should maintain itself against rock friction for even so short a distance as 20 miles.

J. P. LESLEY,

PHILADELPHIA,
1008 Clinton street, August 29, 1890.

REPORT ON OIL AND GAS.

1887, 1888.

By J. F. Carll.

Chapter I.

A review of the Oil and Gas Fields.

During the two years covered by this report—1887 and 1888—the practical drill has been busily at work in the oil and gas fields of western Pennsylvania and New York, and many instructive and important geological facts have been added to our knowledge of the petroliferous rocks; but no new or previously unknown horizon of production has been discovered. At the close of 1888 the oil and gas wells of the entire region are still receiving all their products from the several groups of oil rocks described in the report of 1886, and from no others. This unwelcome sequent to two years' hopeful investigation in a broad field, where new discoveries might reasonably have been expected, cannot be attributed to insufficient exploitation, for never before in the history of oil and gas developments have wells been sunk over such wide areas in the State, and to such extraordinary depths. Nevertheless it would be premature and unwise to infer from these unfavorable disclosures, that all the oil and gas bearing rocks have already been discovered, although the most sanguine oil prospector, as well as the most conservative geologist, cannot but admit that these accumulating negative evidences are gradually narrowing the field of future possibilities.

Following the plan of previous reports, the initial chapter for 1888 will be devoted to a brief review of the several oil districts, to bring the history of oil developments to date, January 1, 1889.

Allegany, N. Y.

A want of profitable drilling ground within tested boundaries, and the unfavorable outcome of experimental tests, made with a view of extending the productive area, have greatly restricted operations in this field, and consequently the production is steadily declining, as seen below.

1886. Number of new wells drilled, 299; 39 of them dry.
1887. Number of new wells drilled, 48; 13 of them dry.
1888. Number of new wells drilled, 42; 14 of them dry.
1886. December average daily production, 5,178 bbls.
1888. December average daily production, 3,300 bbls.

Bradford District.

This grand old field—which first claimed importance in 1876, and since then has produced in the aggregate over 5,000,000 of barrels more than all the other fields combined, still holds the leading place among the productive districts of the two States; but it can now boast only of a large number of very small, long-lived wells. Its borders are well defined and little promising drilling-space remains within them. No permanent betterment of production can be hoped for; nothing but a decline from this time forward is to be expected, unless, perchance, some deeper productive horizon of importance shall be discovered.

No very deep well has been drilled in this district to test the underlying limestones, and only a few holes have gone deep enough to barely reach the Smethport or Elk county sands. But, basing an opinion upon a general knowledge of the character and habits of the deposits in this horizon, it seems hardly probable that the last-named sands will be found in productive condition, except along the southern flank of the Bradford pool and the prospects for obtaining valuable products from the deep limestones are, to say the least, not very encouraging.

Culminating, in 1881, with a total production of about 23,000,000 barrels for the year, the output has been gradually shrinking until in 1888, it barely exceeds 5,000,000 barrels. Yet none of our white sand pools have been so tenacious of life. A dozen of them have been discovered,

depleted, and almost deserted since Bradford commenced to decline. This wonderful district alone has furnished all the world's consumption for the years 1880, 1881 and 1882, and at the same time placed a surplus of about 5,000,000 barrels to its credit in the accumulating stock account. But in 1888 its total output was only about one-fifth of the actual consumption. These facts show how great a factor it has been and still is in the oil trade, and in view of the irresistible decline which has now set in, we may well be solicitous concerning the ability of the white sand pools to supply the demands of future years.

1886. Number of new wells drilled, 413 ; 37 of them dry.
1887. Number of new wells drilled, 142 ; 18 of them dry.
1888. Number of new wells drilled, 49 ; 5 of them dry.
1886. December average daily production, 22,422 barrels.
1888. December average daily production, 17,350 barrels.

In 1888 operations were restricted under the direction of the Producers' Protective Association, a combination of nearly all the leading oil producers of Pennsylvania and New York, for the purpose of stopping the drill and reducing production for the term of one year from November 1, 1887. Probably the effects of this "shut down," which was intended to cover all the oil fields, were seen more sensibly in Bradford than anywhere else. In the ten months immediately preceding the "shut down" 137 wells were drilled ; during the "shut down" year only 22 ; and in November and December following, 32.

In October, 1887, the month before the "shut down," the average daily production was 19,328 ; in November, 14,400 ; in December, 13,070. In October 1888, the last month of the restricted year, 12,529, and in December following, 17,350 (See Chapter II).

Still it is questionable whether the "shut down" reduced the total production of the field in 1888 as much as it is given credit for. The oil shut in at the beginning of the year insured a steady output during the summer and made an increase of production possible after the shut down terminated. In effect it merely reversed the natural drift of

production, making a small output in December, 1887, and a large one in December, 1888.

1885. Total production of Bradford (See table 5), 10,564,298.
1886. Total production of Bradford (See table 5), 9,752,797.
1887. Total production of Bradford (See table 5), 7,580,979.
1888. Total production of Bradford (See table 5) 5,306,062.

On account of the "shut down" the production of Bradford was reduced about 5,000 barrels per day during the months of November and December, 1887, so that the normal production for that year would have been about 7,750,000 barrels, a falling off of 2,000,000 barrels from 1886. Drilling territory was already scarce and torpedoes had been freely used in 1886 and 1887, and in the natural course of events, the production of the field, even if unrestricted could hardly have been 6,000,000 barrels in 1888. Looking at the results in this way, it would appear that the Bradford district was affected by the "shut down" movement only, on an average, about 2,800 barrels per day.

Kane and Elk Districts.

There has been little enlargement of the Kane field since last report, at which time it was already pretty thoroughly drilled. It reached its maximum production in 1886, when the average pipe line runs for the month were 5,702 barrels per day, since which time it has gradually declined to a daily average of 935 barrels for the month of December, 1888.

A few miles southeast of the Kane pool, another district has been opened in Highland township, Elk county, where great activity has prevailed within a somewhat restricted area since the shut down terminated. Up to the present time the development is confined to parts of half a dozen warrants. The wells here produce from a brown sand, probably the equivalent of the Kane sand. None are very large, seldom exceeding fifty barrels, but within the bounds already tested, all are profitable investments. Traces of this sand have been found in a number of experimental wells in other parts of Elk county; and it is to be hoped that the field will enlarge, or other productive pools be dis-

covered in this region, for nearly all the old fields now under the drill are surely on the decline and call for assistance from some new source of supply.

1887. Number of new wells drilled, 75; 14 of them dry.

1888. Number of new wells drilled, 69; 7 of them dry.

Warren and Forest District.

During the period under review the drill has not been remarkably active in this large field of pools; partly on account of the "shut down" movement, but principally for the want of promising territory for the unrestricted wildcatter to work upon. The Clarendon and Kinzua pools have been somewhat enlarged and the surrounding territory has been pretty thoroughly perforated without the discovery of anything of importance.

In the southeastern part of Forest county, near the juncture of Wolf Creek with Spring Creek, a few small wells have been obtained, which give hopes that richer deposits of the Cooper oil sand lie not far away.

1887. Number of wells drilled, 414; 90 of them dry.

1888. Number of wells drilled, 140; 33 of them dry.

The status of the celebrated pools of Cherry Grove, Cooper and Balltown, may be seen from the following comparison of production.

	1883.	*1888.*
Cherry Grove, daily average production, ...	2,070	150
Cooper daily average production, ...	3,002	270
Balltown daily average production, ...	2,127	260

Venango, Clarion and Butler.

The drill has been under less restraint in this large district than in those to the north, and here many prospectors not in affiliation with the Producers' Association have expended their energies. The old fields of Allegheny river, Oil Creek and Pithole have been scenes of considerable activity.

The striking of a 75-barrel well in the second sand on the Blank farm, about 2 miles north of Pithole City, early in 1888, and the opening of other wells in the same sand on the Lytle farm a little later, caused extensive drilling in

these old fields and has added materially to the output. In other parts of Venango county, a good deal of prospecting has been done in territory previously pretty thoroughly tested and where now nothing can be expected but an occasional patch of moderately productive sand.

The prospector in Clarion county has added one new pool at the county seat, Clarion, the oil coming from the lowest member of the Venango group. The sand rock here is white, coarse and pebbly—a better type of the Oil Creek Third sand than any found elsewhere in Clarion county. A few wells in the richest part of the field have yielded very generously, but there is no prospect at present of a farther extension of the rich streak, as dry holes on all sides seem to limit the productive sand-bed to an area of a few hundred acres.

In Butler county some good wells have been found along the borders of the old Butler belt, which has been considerably widened and two rich pools are developing—Glade, in Forward township, and Saxonburg, in Jefferson. The only other new finds north of the Allegheny river are Brush Creek, in Marshall township, Allegheny county; and Bakerstown, in West Deer, Allegheny county, and Middlesex, Butler county.

All the wells in this district draw their oil from some one or other of the members of the Venango group; on the extreme westerly side, principally from the First sand or Hundred foot rock; on the easterly, from some division of sandstone belonging to the horizon of the regular Stray or Third sand.

1887. Number of wells drilled, 837; 249 of them dry.
1888. Number of wells drilled, 963; 231 of them dry.

1,800 480=26.7 per ct.

Washington District.

Including under this head all the territory south of the Ohio River in Beaver, Allegheny and Washington counties, which has been widely prospected for oil and gas, we find that the only new discoveries during the last two years are the Taylorstown, Knox, Canonsburg, Montour, Nineveh,

Murdocksville and Crafton pools. Taylorstown has grown into an important district, Nineveh gives fair promises, but the drilling is so deep and expensive that few operators seem inclined to venture there. Murdocksville is opening up satisfactorily, and Crafton has only recently come into notice.

Several wells that were sunk for gas in this district have turned out moderate oil producers and sufficient drilling has been done in all directions to prove that the oil rocks are deposited very irregularly. No doubt some other rich spots remain undiscovered, but they will be needed as fast as they can be found, and in all probability will never permanently increase the production of the field, judging by the results of the last two years' work.

1887. Number of new wells drilled, 178; 42 of them dry.
1888. Number of new wells drilled, 267; 95 of them dry.

445 137

From which it appears that nearly 31 per cent. of the money expended in drilling has been sunk in dry holes.

On the first of January, 1887, this district was credited with 205 producing wells. Let us look at the production and note the effect of drilling 445 new wells, an addition of 308 to the productive list:

1886. Average daily runs for December,
Washington, ... 121 wells; 8,841 bbls.
1886. Average daily runs for December,
Shannopin, ... 84 wells; 3,031 bbls.

205 11,872

1888. Average daily runs for December,
whole district, ... 513 wells; 7,872 bbls.
1887. Number of wells drilled, 178; 42 of them dry.
1888. Number of wells drilled, 267; 95 of them dry.

445 137

30 .8 per cent. of dry holes.

All the oil obtained in the Washington district is drawn from the sandstones of the Venango-Butler group, except

in two or three instances where the basal sandstones of the Carboniferous group are productive.

Mt. Morris District.

Near the south line of Green county and extending across it into West Virginia, a new oil and gas field was discovered in 1886. Lured by the old developments in the Dunkard Creek field, the prospectors' drill had been sent forward into this region to search for a southerly extension of the Washington county sands. Several shallow wells were drilled with rather indifferent success, and then deep drilling was undertaken. The first well to tap oil in a deeper sand than the Dunkard Creek oil horizon was Hukill, No. 1, on the D. L. Douley farm on Morris Run, Perry township, about a mile north of the West Virginia line, which made a very favorable showing, at a depth of about 1,750′, in the month of October, 1886.

But this rock was not then recognized as a profitable oil be r; and as the Washington sands were supposed to be much higher, little attention was paid to the well after the first flurry of excitement died away. Several other wells were drilled, however, and carried deep enough to show that the Washington sands are not to be relied upon in this locality. The pioneer well was also drilled deeper with like results. It was then decided to plug the bottom of the hole and torpedo the well at about 1,750′. The response was more generous than anticipated, and being followed by a well-sustained production, gave courage to operators who have since urged on the drill and developed a very promising oil field.

The oil sand is known in drillers' parlance as the "Big Injun," on account of its great thickness, which sometimes exceeds 300 feet. In the northern oil fields this rock is seldom over 50 feet thick; and drillers generally include it in their mountain sands, as it lies about 400 feet above the top of the Venango group. The rock thickens rapidly from Butler county southward, as shown in Chapter III; but Mt. Morris is the only locality now known in the State where it produces oil in large quantities. At present the field seems

to be a promising one ; but, like other oil pools, it is evidently limited in area by the local constitution of the rock, its dips, and the proximity of salt water in certain directions. The first pipe line runs from the field were reported in June, 1888, and in December the daily runs for the month averaged 729 barrels, almost equal to the runs from the old district of Shannopin for the same month.

Recapitulation.

Glancing over the chain of oil pools which now extends entirely across the western part of the State and overlaps both into New York and West Virginia, one cannot fail to be impressed with the facts that very few fresh or undepleted fields of production are in sight; and no very wide untested areas where others of promise may be concealed remain within the limits of the productive rocks as defined by the drill and verified by twenty-nine years of persistent investigation.

The following tables show that during the last two years 2,413 productive wells and 811 dry holes have been completed, nearly all of them being located within these prescribed limits ; and, in addition to these, several hundred gas wells have been sunk, all of which are so many negative tests for oil. The same territory is to be worked over in the future, for at present no other is in sight ; and as every new pool discovered and depleted reduces by so much the quantity of oil remaining in the underground storehouses, it seems evident that the time is not very far distant when all the important pools shall have been discovered and the producer be forced to content himself with the gleanings from these gradually exhausting fields.

We have seen that all the old districts are on the decline. The drilling of many wells in developed territory and the discovery of occasional pools of small capacity may keep up present production, or even increase it temporarily ; but there is nothing to warrant the hope that these old fields may be resuscitated and their production brought up even to that of 1886. In August of that year, Washington, Shannopin and several smaller white sand pools were in

their prime, and the average daily production of the white sand division was 45,560 barrels, while Bradford and Allegany added 32,668 barrels, making a total of 78,228 barrels. Since then both white sands and black sands have been steadily decreasing in output, until in December, 1888, the former only gave 29,349 barrels, and the latter 20,680 barrels. Total, 50,029 barrels.

1886. Total production of all fields, 25,080,460.

1887. Total production (1,694 new wells), 21,286,560.

1888. Total production (1,530 new wells), 16,126,580.

It may be said that the "shut down" is responsible for the decrease in 1888, but only a small percentage of it can be accredited to its influence; for it is plainly to be seen that the decline had been going on before the shut down went into effect and that it did not accelerate it (considering the whole yearly output) to the extent of 1,500,000 barrels.

Daily average, October, before the shut down, 58,942 barrels.

Daily average, December, after do., (1,733 new wells); 50,029 barrels.

Review of Gas Pools.

The natural gas fields of western Pennsylvania may be divided into two geographical districts, a northern and a southern; we may also make two geological divisions of the gas-producing rocks, drawing the line of separation at the base of the Venango group between Formation No. VIII and Formation No. IX.

Northern Gas District. Practically all the natural gas now being utilized commercially through the pipe lines of McKean, Potter, Elk, Warren, Forest and Venango counties comes from rocks of Portage-Chemung age (Formation No. VIII). Of course a small quantity yet remains in the sands of the Venango group (Formation No. IX) in Venango county and western Forest; but it is of no value except for local use at or near the wells which produce it.

Southern Gas District. South of the counties above named all the commercial product is derived from newer strata than No. VIII, except that in Indiana and Jefferson counties,

which supplies Punxsutawney and a part of that which insufficiently serves Brookville.

By far the most productive horizon of this district is the First sand of the Venango-Butler group, this being the great repository in Grapeville and Murrysville, Westmoreland county, and also the principal one in Allegheny, Washington and Beaver counties. But the gas in this district is not confined to one horizon nor to one system of rocks. It occurs abundantly in one locality or another in each of the leading sandstones of the oil group, in the overlying Butler gas sand, the Berea grit, the Sub-Olean—Shenango sandstone ("Big Injun" of the southwest) and even as far up as the Homewood—the top member of the conglomerate series—thus ranging through four complete divisions of the geological scale Nos. IX, X, XI and XII.

We have no warrant for inferring that the older sands are more plentifully charged with gas than those of more recent age; neither do they seem likely to prove capable of greater endurance under similar treatment; but, postulating that every gas-pool contains a fixed quantity of gas already stored and awaiting liberation, it is evident that the life of a pool does not depend so much upon the quantity of gas accumulated as upon the comparative rapidity with which it is allowed to escape. Given two deposits of equal capacities and pressures—if A suffers depletion by 10 wells in 5 years, B ought to be equally depleted by 50 wells in 1 year. In fact B should be most exhausted; for, having five times as many vents as A, the gas need travel but a short distance in the rock to reach an outlet, and hence, suffering less retardation from friction, would escape more rapidly.

The Devonian sands of No. VIII have a wide range in the northern district, and lying far removed from any great center of population and manufactures are not being very exhaustively drawn upon; whereas the gas sands within 40 miles of Pittsburgh (and this radius would probably include all the deposits from which commercial gas can reasonably be expected) underlie a populous manufacturing district, where immense supplies of the newly-applied fuel are

demanded; where every gas pool discovered is speedily taxed to its uttermost and the search for new ones is ever active. In addition to this, much of the gas that rightfully belongs to Pittsburgh is being diverted westward into Ohio and West Virginia. Under these circumstances, the pools of the southern district are doomed to comparatively speedy exhaustion, however large their aggregate capacity may prove; and it is highly probable that the northern gas mains, delivering from the older and more moderately taxed rocks, will be in successful operation after the southern have practically exhausted their accumulated supplies.

It is generally understood that the strongest rock pressures obtain in the deepest wells; and the theory of *hydrostatic pressure* has been appealed to to account for the fact. No one however has yet been able to work out from actual observations of the phenomena presented by flowing oil and gas wells, any absolute and uniform correspondence between increasing pressures and increasing depths, as compared with the immediately overlying surface, or with distant elevated outcrops of the producing strata.

If an oil well is simply an artesian well, should not its flow be constant while it lasts, and dependent upon the rapidity with which the impelling water invades the oil-rock-reservoir; and after displacing the oil, ought not water to follow into the well and rise to the surface, or at least to the level indicated by the strength of its initial oil flow?

But oil and gas wells do not act in this way. The output decreases gradually and sometimes rapidly from the start; and after production has settled almost to its minimum the wells may be pumped for years and even subjected to the drafts of gas pumps without being flooded with water, provided the abandoned wells in the pool have been effectively plugged above the oil and gas rock.

It is a well known fact that the oil sand in the celebrated Triumph district, which has been under the drill and pump over 22 years, and produced in the aggregate fully 5,000,000 barrels of oil accompanied by large volumes of gas, is now so voided by the use of gas pumps that a vacuum gauge at

any of the well heads registers a downward pressure of 12 to 13 pounds per square inch. This has been the situation for many years, as gas pumps have constantly been in operation in that district since 1869. New wells are occasionally drilled on this exhausted belt, and it invariably happens that when the oil sand is pierced a current of air commences to whistle down the hole, nor can any oil be obtained till the well mouth is closed and a gas pump put in operation. After a few days' testing, oil begins to appear, and the production frequently runs up to 15 to 20 barrels per day. Then, as the slight excess of fluid in the immediate vicinity of the hole drains, and an equilibrium is established, the output gradually shrinks to the level of the old wells in the pool.

The wells at Triumph are from 600 to 800 feet deep, and usually have only about 200 to 250 feet of casing in them. Consequently some four or five hundred feet of the bore hole is bare rock, equally exposed to the draft of the pump as the oil rock itself. In this uncased portion of the well are the first and second sands which also outcrop in the river hills within two miles of the exhausted pool ; and one member of the second sand forms a part of the river bed a mile farther north ; and yet no surface water or air finds access to the wells through these sources.

Many other proofs of the impermeability of the strata above the oil rocks, and of the fallacy of the hydrostatic theory could be adduced, were it necessary. In a practical experience of twenty-three years in the oil regions I have never witnessed nor heard of a single circumstance to support it. The theory as applied to Pennsyivania oil and gas wells is delusive and untenable ; and the cause of the great rock pressure witnessed must therefore be sought for in some other direction.

No very important additions were made to the gas pools of the northern district during 1887 and 1888. In the three leading fields, Wilcox, McKean county ; Sheffield, Warren county, and Speechley, Venango county, considerable drilling has been required to keep up needed supplies ; but as

the gas areas are large and not yet decisively outlined, there are still many promising locations for additional wells. The only new pool discovered and practically utilized through a regular system of pipe lines is the East Hickory pool, located on the county line between Warren and Forest, about two miles east of the Allegheny river. This now supplies the town of Tidioute and vicinity, and is apparently a deposit of considerable importance.

In Elk county the irrepressible oil prospector has unintentionally opened a number of good gas wells, and thus revealed the presence of available stores in that region which can be utilized when needed. But farther south, at Reynoldsville, Du Bois and Clearfield, the outlook is not so hopeful, since all the wells drilled there have been failures. These widely scattered tests, however, should not be considered conclusive. It is not at all probable that the Venango group will yield oil or gas in paying quantities in these localities; but the well drillings show favorable evidences of some of the Devonian sands, and quite possibly some production may yet be obtained from them.

The progress of developments in the Southern district has been more eventful than at the north. An ever growing and unsatisfied demand for natural gas has stimulated exploitation and encouraged speculation in prospective gas properties. Known fields have been rapidly drilled and new ones anxiously sought after. Some of the old pools, notably Lardintown, in Butler county, and Tarentum in Allegheny, have ceased to be of practical importance. Northwestern Butler has failed to meet the expectations of those who were relying upon it for supplies; and the deposits in central Butler, which lie principally in the Butler gas sand, prove smaller and less enduring than was anticipated.

In southern Butler and northern Allegheny several fine gas wells have beened opened by oil seekers; and during the latter part of 1888 the Bridgewater Gas Company, whose supply was seriously diminishing in Beaver county, found relief by laying an additional line into this field. In the

region bordering the Ohio River—Baden, Economy, Sewickley, etc.—many good wells have been secured and considerable gas yet remains for local use. Here the productive sands are deposited irregularly, but probably they will in some localities produce both oil and gas.

The old Kittanning gas pool in East Franklin and the northwest part of Valley township, Westmoreland county, still produces freely, and amply supplies the original pipe lines connecting it with the town of Kittanning. But within the last two years a new consumer has entered the field. A very extensive plate-glass plant has been erected at Ford City, about three miles south of Kittanning, and it is evident that additional gas supplies will soon be needed. A number of test wells have already been sunk on the east side of the river but with rather discouraging results. Some gas has been obtained, but as yet no indications of larger deposits have been discovered.

The Pine Run pool in Washington and Allegheny townships, Westmoreland county, has been considerably enlarged, and the gas, which comes from a sand belonging to the second sand horizon, lying about 125 feet below the Murryville gas sand, proves abundant and reliable. From this field the Pine Run National Gas Company serves among others the towns of Apollo, Leechburg, Freeport and Natrona.

The Murrysville belt seems now to be pretty definitely outlined, and has undoubtedly reached that stage of development to which all oil and gas fields sooner or later come, when no additional number of wells can stay the inevitable decline of production. On January 1, 1887, the belt was credited with 74 wells, and two years later with over 150, from which it appears that doubling the number of wells did not increase the production materially, otherwise it would not have been necessary to reinforce its output by extending the Pittsburgh gas mains to Grapeville, as was done in the fall of 1888.

The following brief summary of the early developments in the Murryville district, prepared from the notes of the survey of the Natural Gas Supplement of the *American*

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Manufacturer and Iron World December 30, 1887, may very properly be put on record here:

"The first well at Murrysville was completed November 3, 1878. It was drilled for oil, and the intrusion of gas in such volume and force as to prevent deeper drilling, was a disappointment to the owners. An oil well would have given them immediate returns for their outlay, but an uncontrollable gas well in that locality could bring in no revenue unless additional capital was invested in providing the appliances for ultilizing its product. The conveyance of natural gas through pipe lines of considerable, length, and its utilization for manufacturing and domestic purposes, were no new things at that time, for as early as 1872, the Newton gas well in Crawford county, through 5½ miles of 3¼-inch pipe, supplied over 250 fires (large and small) at refineries, manufactories and dwellings in the city of Titusville; in the fall of the same year, the Fairview well in Butler county, furnished fuel-gas through 7 miles of mains to Fairview, Petrolia, Karns City and Argyle; in 1875, nineteen miles of 6-inch pipe were laid from the Lardentown gas well in Butler county to Sharpsburg and Millvale, to furnish fuel for the iron mills; in scores of other places in the oil regions gas had been piped to distances varying from a few hundred feet to five miles, and employed for steam-generating and domestic purposes. All these plants worked satisfactorily; yet, incredible as it may seem, notwithstanding these positive proofs of the practicability of piping natural gas, and of its superior excellence as a fuel, Pittsburgh capital could not be induced to invest in Murrysville gas; and no attempt was made to pipe it to Pittsburgh until men from the oil regions came into the field in 1882; and then the first gas piped came from new wells, old Haymaker No. 1, not being connected with the lines until late in 1883.

"The second well in the field was completed August 20, 1882; the third, February, 1883; in which year more active operations commenced.

"*January 1, 1885.* On this date the Murrysville pool, extended southward to include Lyon's Run and the Daum

farm, contained 14 completed wells, which had been drilled in the following order:

"1. Haymaker, No. 1, Remaley farm, Murrysville, November 3, 1878.—2. Pew & Emerson, No. 1, Fundis farm, Murrysville, August 20, 1882.—3. Boulton & Doubleday, No. 1, Remaley farm, Murrysville, February, 1883.—4. Hostetter & Brown, No. 1, Harvey farm, Murrysville, March 20, 1883.—5. Haymaker, No. 2, Cooper farm, Lyons Run, April 25, 1883.—6. Boulton & Doubleday, No. 2, Cooper farm, Lyons Run, July, 1883.—7. Hostetter & Brown, No. 2, Harvey farm, Murrysville, December 20, 1883.—8. Boulton & Doubleday, No. 3, Cooper farm, Lyons Run, (?) 1883.—9. Hukill, No. 1, Dick farm, Lyons Run, March 1, 1884.—10. Philadelphia Company No. 1, Verner farm, Murrysville, May 1, 1884.—11. Pew & Emerson, No. 2, Meanor farm, Murrysville, August, 1884.—12. Hukill, No. 2, Daum farm, Lyons Run, August 2, 1884.—13. Hukill, No. 3, McWilliams' farm, Lyons Run, November 1, 1884.—14. Hostetter & Brown, No. 3, Stewart farm, Murrysville, December 20, 1884.

"At that time Nos. 6 and 8 were connected with the Acme Gas Company's line to Braddock, etc., which line first commenced to deliver gas December 1, 1883.

"Nos. 1, 2, 4, 5, 7, 11 and 14 were connected with the Fuel Gas Company's lines to Pittsburgh.

"Nos. 9, 12 and 13 belonged to the Carpenter Natural Gas Company, which made its first delivery at McKeesport, January 8, 1885.

"Nos. 3 and 10 were blowing into the air, the first being small, the last very large. There were also 7 wells drilling or preparing to drill.

"*January 1, 1887.* Seventy-four wells completed, and developments extended about a mile northeast of Murrysville.

"*November 1, 1887.* One hundred and fourteen wells completed, and developments carried northeastward to Pucketta Creek, making the present length of the belt about 8 miles. The southerly end of the gas deposit is definitely fixed near the Daum farm (the gas rock south of that being flooded with water), but the northerly end is not yet fully defined,

although recent developments on that end of the belt seem to indicate nothing very promising north of Pucketta Creek —at least nothing in direct connection with the Murrysville pool."

Although large quantities of gas had been allowed to go to waste in the Murrysville field, comparatively little had been piped from it prior to November 1, 1884. If we take this date for the commencement of the general pipe line deliveries, the field has now (Jan. 1, 1889) entered upon the fifth year of its exhaustion. It is said by those who are qualified to judge of the matter that an average of at least 300,000,000 cubic feet of gas per day has been drawn from the pool during the last four years. To get some conception of the enormous storage capacity of a rock capable of making such an output, let us look at the following simple calculations and comparisons:

A standard oil barrel of 42 gallons contains (42x231) 9,702 cubic inches or 5.6146 cubic feet. Under a rock pressure of 900 pounds, or 60 atmospheres to the square inch, every cubic foot of storage room in a gas sand should contain 60 cubic feet of gas. Hence a rock chamber capable of holding a barrel of oil would be able to hold 60 times that amount of gas or (5.6146x60) 336.8760 cubic feet, consequently a gas well flowing 3,368,760 cubic feet of gas per day, would, theoretically, relieve as large a space in the rock-reservoir as an oil well flowing 10,000 barrels per day—and a gas well of 33,687,600 cubic feet (some wells have been estimated as high as this) would equal an oil well of 100,000 barrels.

Multiplying the daily average by the number of days in four years, we have (1,460x300,000,000) 438,000,000,000 cubic feet as the total output of gas. Reduced under 60 atmospheres this would occupy a storage space of 7,300,000,000 cubic feet—a chamber which would contain 1,300,181,669 barrels of oil, almost four times as much as has been produced in the whole oil regions of Pennsylvania and New York since the discovery of oil in 1859. A reservoir capable of holding this enormous quantity of fluid would require to be a little over 13 miles long, 2 miles wide and 10 feet deep.

The Grapeville pool has not been very exhaustively drawn upon up to the present time. Comparatively little drilling was done there in 1886 and 1887, as only a few wells were needed to satisfy the then existing demands upon it. During 1887 the Westmoreland and Cambria Natural Gas Company's line to Johnstown, had an abundant supply from only 4 wells. But at the close of 1888, we find 8 wells connected with the Johnstown line, and 5 with the Southwest Company's line to Connellsville, Uniontown, etc. The Philadelphia Company and the People's Company of Pittsburgh, have extended their mains from Murrysville and are utilizing 8 or 10 wells. The line of the Greensburg Fuel Company, the Jeannette Glass Works, Mr. Carnegie and others are also drawing from the field. About 35 wells have been drilled, and 6 or 8 sets of tools are actively at work in further developments. The capacity and endurance of the field will now be speedily tested, but as the gas deposit is supposed to be about 12 miles long, it promises to afford drilling room for some time to come.

The unsuccessful results of the test wells at Indiana, Black Lick, Saltsburg, Blairsville, Latrobe, Waltz's Mills, Layton Station and other places in Indiana and Westmoreland counties, discourage the hope of finding any other large deposits of gas in these counties equal to those already discovered. Moderate, but rather unsatisfactory, wells, like those northeast of Latrobe, in Westmoreland, and east of the river near Brownsville, and Belle Vernon in Fayette, may perhaps be discovered in other localities; but nothing that can take the place of Murrysville and Grapeville, when they fail, can reasonably be expected east of the Allegheny and Monongahela rivers. Enough wells have already been drilled to show the unreliability of the Butler-Washington group in this region, and there is nothing to indicate that there are any other oil or gas bearing rocks below it.

In Fayette county, a very vigorous flow of gas was struck on the Ryder farm, in 1887, by the Fayette Fuel Gas Company. It was piped about 6 miles to the borough of Uniontown, where it still satisfactorily supplies a large number of consumers with apparently undiminished force. The

well is located in German township, nearly midway between Uniontown and Masontown. Near it two others of smaller capacity have been drilled, one of which is blowing off into the air. As the gas comes from the "Big Injun" (Sub-Olean-Shenango sandstone), which is so prolific in the Mount Morris field, 16 miles southwest of this well. It seems highly probable that other pools of gas and possibly oil, will yet be discovered in the same horizon in the southern part of Fayette county.

In the southwestern quarter of the field, the old gas pools are gradually exhausting under the excessive drafts made upon them. Pressures in Beaver county have sensibly declined, and although the possible gas area is large, the necessary supplies for existing pipe lines are obtained with a great deal of difficulty, and it cannot be long before all the commercially available stores of this region will be practically exhausted. The same is true of western Washington—the gas is evidently failing; and no extension of lines to the northeast is practicable, for the Pittsburgh companies have already prospected and are depleting all that country. From southern Allegheny and eastern Washington, large quantities of gas have been marketed and no doubt much more remains to be extracted, but the region has been so thoroughly prospected for both oil and gas, that there seems to be very little probability that any very large deposits have escaped notice.

The most promising field in that direction at the present time is the Belle Vernon pool in Fallowfield township, Washington county, where a very strong well was struck in September, 1887 and another in May, 1888. These wells are reported to have a rock pressure of 800 pounds to the inch, and it is probable that a field of considerable importance will be developed here; and possibly the belt may prove productive somewhere northeast of the Monongahela river. The gas appears to come from the 50 foot rock or lower member of the First oil sand.

The list given on a previous page shows that over 300 wells were drilled for oil in Allegheny, Beaver, Washington and Greene, during the years 1887 and 1888. In the same

time probably 150 more were drilled for gas in these counties and Indiana, Westmoreland and Fayette. Judging from the results of this drilling and the records of the wells that have been secured for study, it seems highly improbable that Pittsburgh's gas service will ever be sensibly augmented from fields north of the Ohio river. East of the Allegheny and Monongahela rivers, the disclosures made by the prospecting give little hope of future discoveries of any great or lasting practical value. Some small gas areas may be unlocked by future developments, but nothing can be seen at present to stimulate the hope of finding another pool in this region similar to those of Murrysville and Grapeville.

The country west of Pittsburgh is already practically tested as has been shown above; gas pressures are weakening in the old districts; a number of companies (some of which are piping gas northward and westward) are operating in the region, and all of them are diligently searching for new supplies; hence Pittsburgh cannot reasonably look for any great or permanent increase of production from that direction. Its only available field of future extension seems therefore to be narrowed down to the counties of Washton and Greene, and even here the area of possible production is materially restricted by the irregularities of the oil group and the prevalence of salt water in the sandstones; still it is probable that Pittsburgh will derive great benefit from this region during the next few years.

It may be thought by some of my readers that too gloomy an outlook has been depicted in this chapter. If so let them candidly review the facts presented here and in other parts of this report and see if they do not justify all that has been said.

Has not the history of the first oil and gas pool in Pennsylvania been repeated in every one of them so far discovered? Does not each one develop or grow up to its culminating point and then decline? After twenty-nine years of prospecting and the discovery of about 150 oil and gas pools, has one yet been found that maintained a perennial output?

Having convincing experimental evidence that all oil and gas pools are exhaustible, that a number have already been practically drained, that nearly all those under the drill have passed the summit of production and are now irresistibly gravitating on the downward slope; and having been taught by geologic study of the facts that the productive area is being reduced from year to year by the new pools discovered and depleted within it, and also narrowed and defined by the great number of unsuccessful and ill-omened wells sunk along its borders, one would be inexcusable if he neglected to call attention to these things.

Little more than twenty-nine years have passed since the first oil well was struck in Pennsylvania. A brief time historically, but full of wonderful achievements in developing the oil fields, in originating and perfecting pipe line systems, in refining the crude product and introducing a new light throughout the world! From a zero point the business has expanded until 75,000 barrels of crude per day are now required to satisfy the demands of trade. Already about 58,000 wells have been sunk, and as they are scattered over every part of Western Pennsylvania, the geographical locations and outlines of all the *known* oil beds have thus been approximately defined by the drill and a pretty complete knowledge of the constitution and structure of the underground to a depth of several thousand feet has been obtained.

Experience has demonstrated that oil and gas pools are exhaustible, and that a constant production of oil or gas can only be maintained by sinking new wells and adding new pools to those already developed. Hitherto with a wide range of new territory to work upon, this has been possible; but the situation has changed and is changing rapidly. More than 150 pools of oil and gas have already been developed; they are scattered all along the great oil belt and, as far as can be judged, cover the most prolific parts of it. Is not the area left for future discoveries in the state greatly contracted thereby? Is it probable that a production of 70,000 barrels per day or even 60,000 barrels can be maintained in Pennsylvania for the next five years unless some

new oil horizon be discovered of which the prospecting of twenty-nine years has failed to give us a hint? If not, then it is fortunate for the consumers of oil that Ohio has become an oil producer and that Kentucky, Colorado, California, Wyoming and Texas are anxious to take a hand also.

It is *not claimed* in any part of this report (nor indeed in any previous one) that the oil and gas fields of Pennsylvania *are exhausted*, nor that they will be completely drained in *a very few years*—although speaking comparatively and with reference to geologic time, the latter expression might be allowable. But it *is* claimed that they have been excessively and wastefully depleted, that all the fully developed pools are surely on the decline, that every pool depleted lessens by just so much the area to be profitably drilled, and every year's unsuccessful prospecting outside of the productive belts and of deep drilling within them, makes the outlook for the discovery of new oil horizons less hopeful, that from this time forward we have no reasonable ground for expecting, or even hoping, that these oil fields will continue to supply the world with cheap light as they have in the past and that therefore it is wise to pause and consider how best to husband our remaining resources and make the most of them.

And when we remember that the piping of natural gas on a large scale is now only in its fifth year; that the demands for daily consumption have grown to over 500,000,000 cubic feet per day, and are still increasing; that nearly all the gas pools now in sight show evidences of gradual failure; and that a large proportion of the available gas territory in the state has already been more or less thoroughly prospected—we are forced to the conclusion that the continuance of gas supplies are even less certainly assured than the continuance of oil supplies. At any rate the time has evidently come, when the natural gas companies should insist upon a fair compensation for the gas delivered, and enforce economy in using it; for it is too valuable a product and too evanescent to be recklessly wasted and consumed as it has been in the past.

These conclusions are not novel, nor have geologists only recently awakened to a realization of the facts, as may be

seen from the following extract from an address delivered by Prof. J. P. Lesley, the State Geologist, before the American Institute of Mining Engineers, in Pittsburgh, February, 1886.

"I take this opportunity to express my opinion in the strongest terms, that the amazing exhibition of oil and gas which has characterized the last twenty, and will probably characterize the next ten or twenty years, is nevertheless, not only geologically but historically, a temporary and vanishing phenomenon—one which young men will live to see come to its natural end. And this opinion I do not entertain in any loose or unreasonable form ; it is the result of both an active and a thoughtful acquaintance with the subject. From the time that Colonel Drake sunk the first well on the plains of Titusville, I have professionally participated in the history of the oil and gas developments, and believe myself to be familiar with whatever has been said and done in the premises ; and there does not remain upon my mind a shadow of doubt respecting the practical extinction, in the comparatively near future, of that great commerce in oil, of which the people of Pennsylvania have foolishly taken so little advantage, when they might have accumulated from its sale in all quarters of the world a provision of moneyed wealth unheard of in the history of our race. The opportunity is indeed still offered, but it is steadily diminishing, and in a few years it will entirely pass away never to return again. For I am no geologist if it be true that the manufacture of oil in the laboratory of nature is still going on at the hundredth or the thousandth part of the rate of its exhaustion. And the science of geology may as well be abandoned as a guide, if events prove that such a production of oil in western Pennsylvania as our statistics exhibit can continue for successive generations. It cannot be. There is a limited amount. Our children will merely, and with difficulty, drain the dregs.

"I hold the same opinion respecting gas, and for the same reasons, with the difference merely that the end will certainly come sooner and be all the more hastened by the multiplication of the gas-wells, and of the fire-boxes and furnaces to which it is led."

Chapter II.

Statistics of Oil Production from 1859 to 1889, with Chart No. 3, and Page Plate No. 1, showing Production, Shipments and Stocks for each year since 1875; and Page Plate No. 2, showing the relative proportions of Black-sand production and White-sand production during the same years.

A graphic chart, No. 1, giving the statistics of production, shipments, etc., from the oil fields of Pennsylvania and New York for the years 1859 to 1882, inclusive, was prepared early in 1883 and accompanied the report on Warren county (I^4). Three years later it was reproduced in the annual report for 1886 with the statistics for the years 1883, 1884 and 1885 added. As it appears in both reports without any reference to it in the text, we may here give a few facts in relation to the data used in its compilation.

In constructing the original draft, all available authorities on oil statistics were consulted; the current oil reports of each year were carefully examined and compared, and whenever the published tables of early production showed unmistakable evidence of unreliability, all the facts at command were duly weighed and corrections made accordingly. It was found that several important errors had crept into the current production-tables and been carried down from year to year without detection. The table of early produc-

tion which has been and still is most generally copied, originated in the office of the Titusville *Morning Herald*, and may be found in its "Annual Petroleum Circular," dated February 1, 1869. There was no better authority at that time, yet we find it giving the total production for 1859 as 82,000 barrels, an error so glaring that the wonder is how it originated. The Drake well, struck on the 28th of August, was the only one actually producing during 1859. Its production was variously reported by some as thirty barrels per day, by others as low as eight barrels. Probably sixteen barrels would be a large allowance. Hence, as the well was only 125 days old at the close of the year, and had been pumped intermittently all the while, its production could not have exceeded 2,000 barrels.

In 1860 the total production is put in the tables of the *Herald*, *Stowell's Petroleum Reporter* and the *Petroleum Age* at 500,000 barrels; in other reports it varies from 547,439 to 650,000 barrels, all of which are evidently largely in excess of the actual output that year, as the following facts show.

The first systematic report of pumping and drilling wells in the Pennsylvania oil regions was published in the *Venango Spectator*, of Franklin, July 11, 1860. At that time there were 13 wells pumping a total of 64 barrels per day; one well "testing" and producing for the moment "6 gallons per minute," and 137 wells in various stages of drilling, on the several farms between Oil City and Titusville; all of which are mentioned in detail.

The next week, July 18, the same paper reports in the Franklin district, 11 wells producing from 5 to 25 barrels each, 9 wells testing and 36 drilling; also 15 wells drilling in the Tidioute district.

Summarizing these reports it would seem that in July, 1860, there were about 188 wells drilling and 34 wells testing and producing in the region—the total production of which could hardly have exceeded an average of 300 barrels per day for the month.

The Pittsburgh *Chronicle* of August 15, 1860, estimated the production at that time thus: Franklin, 31 barrels;

Franklin neighborhood, 43 barrels; Lower Oil Creek, 141 barrels; Titusville, 125 barrels; total, 339 barrels daily.

On the 21st of November, 1860, the *Venango Spectator* published "a list of all the producing wells in the Venango Oil Regions," giving names of wells, owners and location of farms, from which the following is condensed:

French creek, ...	3	pumping,	daily	production,	35	barrels.
Two Mile Run, ...	3	"	"	"	64	"
Franklin Boro', ...	15	"	"	"	139	"
Parker farm, Oil creek, . . .	5	"	"	"	120	"
Watson farm, Oil creek, . . .	3	"	"	"	66	"
Robinson farm, Oil creek, . .	2	"	"	"	29	"
Griffin farm, Oil creek, . . .	1	"	"	"	3	"
Poff farm, Oil creek, ...	1	"	"	"	4	"
Steel farm, Oil creek, ...	2	"	"	"	16	"
G. W. McClintock farm, Oil creek, ...	1	"	"	"	6	"
Rynd farm, Oil creek, ...	1	"	"	"	6	"
John McClintock farm, Oil creek, ...	2	"	"	"	18	"
Buchanan farm, Oil creek, .	2	"	"	"	33	"
H. McClintock farm, Oil creek,	8	"	"	"	85	"
Clapp farm, Oil creek, ...	3	"	"	"	72	"
Graff & Co. farm, Oil creek, .	2	"	"	"	27	"
Tidioute and vicinity, Allegheny river, ...	8	"	"	"	200	"
Goodman farm, Allegheny river, ...	1	"	"	"	6	"
Anderson farm, Allegheny river, ...	2	"	"	"	42	"
McFate farm, Allegheny river,	1	"	"	"	12	"
Russell farm, Allegheny river,	1	"	"	"	5	"
Renouf farm, Allegheny river,	1	"	"	"	40	"
Downey farm, Allegheny river, ...	1	"	"	"	25	"
Hays farm, Allegheny river,	1	"	"	"	25	"
Wilson farm, Allegheny river,	2	"	"	"	37	"
Brandon farm, Allegheny river, ...	1	"	"	"	10	"
Three miles below Franklin .	1	"	"	"	40	"
Totals, ...	74	"	"	"	1165	"

Average daily production, $15\frac{74}{100}$ barrels per well.

Making a very liberal estimate from these reports it is seen that the total production for 1860 could not possibly have reached the aggregate of 500,000 barrels, but indeed it

is more likely to have fallen short of the 200,000 barrels allowed on the chart.

First 6 months, ...	182	days,	daily	average	say	200	bbls. =	36,400
July, ...	31	"	"	"	"	400	" =	12,400
August, ...	31	"	"	"	"	500	" =	15,500
September, ...	30	"	"	"	"	700	" =	21,000
October, ...	31	"	"	"	"	900	" =	27,900
November, ...	30	"	"	"	"	1,200	" =	36,000
Deeember, ...	31	"	"	"	"	1,500	" =	46,500
Total for year, ...		"	"	"	"			195,700

These details are given for the purpose of placing historical facts among the records of the Survey and to show the unreliability of the early estimates of production which have been so universally copied by compilers of petroleum statistics. Nor are the inaccuracies confined altogether to the first ten years ; they run all through the records. Typographical errors and erroneous summations made in the originals have been copied and carried forward without correction, and in many cases the pipe line receipts and deliveries have been carelessly increased by duplication of quantities which merely passed from one line to another or diminished by omissions in some part of the field. No one seems to have taken the trouble to verify the published tables as they appeared from year to year, and now there are so many varying reports that it is difficult to decide which one may be the most reliable.

The chart follows more closely than any other the table published in the *Petroleum Age* in June, 1882 ; but numerous corrections have been made where palpable facts, like those mentioned above, rendered corrections necessary. Of course it cannot be claimed that the chart is without flaw, but when all its elements of production, shipments and stocks are taken into consideration it is believed to be as evenly balanced, as consistent in details and as near an approximation to the truth as anything published.

The following tabulations and notes appeared on chart No. 1, in 1883.

TABLE No. 1, *Showing the Yearly and the Total Production of the several Oil Districts of Pennsylvania and New York, from the commencement of developments to January 1, 1883.*

YEAR.	Oil Creek Division.	Central Allegheny Division.	Tidioute & Fagundus Division	Beaver & Smith's Ferry Div.	Pit Hole & Cashup Division.	Butler & Armstrong Division.	Clarion Division.	Bradford Division.	Warren & Forest Division.	Bullion Division.	Allegany County Division. New York.	Total barrels of 42 Galls.
1859,	2.000											2.000
1860,	120.000	75.000	5.000									200,000
1861,	1,870.000	170.000	50,000	20,000								2,110.000
1862,	2,860.000	125,000	40.000	30.000								3.055,000
1863,	2.480.000	80,000	30.000	20.000								2,610,000
1864,	2,000.000	85,000	30.000	15.000								2,130.000
1865,	1.600,000	100.000	100.000	20.000	900.000	1.000						2.721.000
1866,	2.000,000	200.000	600.000	25,000	900,000	5.000	2.000					3.732.000
1867,	1,950.000	200.000	850.000	20.000	550,000	8,000	5.000					3,583.000
1868,	2,300.000	300.000	750.000	20.000	300.000	25,000	20,000	1,000				3,716.000
1869,	3.000.000	350,000	800.000	20.000	100,000	45,000	35.000	1.000				4.351,000
1870,	2.900.000	400.000	1,000.000	20.000	75.000	900,000	75.000	1,000				5.371.000
1871,	2,200.000	800.000	1.000.000	20,000	100,000	1,100,000	310.000	1,000				5,531,000
1872,	1.700.000	800.000	1,160,000	25,000	200.000	1.700.000	830,000	2,000				6,357.000
1873,	1.200.000	800.000	900,000	30.000	100.000	4,400.000	2.500.000	2.000				9.932.000
1874,	800.000	500.000	400,000	30,000	50,000	5,200,000	3,900.000	3,000				10,883.000
1875,	550.000	400.000	350,000	35,000	40.000	4,650,000	2.750,000	25.000	1,000			8,801.000
1876,	650,000	350,000	350.000	35,000	30.000	4,700,000	2,400,000	380,000	55,000	65,000		9,015,000
1877,	800.000	450,000	310,000	62.000	15,000	5.500,000	3,000,000	1,450,000	150.000	1.306.000		13,043,000
1878,	750,000	350.000	300,000	92,000	10,000	4.500.000	2,250,000	6,500,000	110.000	505,000		15,367.000
1879,	500,000	250,000	250,000	82.000	5,000	2.800.000	1.400.000	14,200,000	50.000	290.000		19,827.000
1880,	400.000	170,000	230,000	103.000	3.000	1.700.000	900.000	22,300,000	90,000	147.000	5.000	26,048.000
1881,	350,000	150.000	220,000	100.000		1.400,000	850.000	23,000.000	440,000	128.000	600,000	27.238,000
1882,	280,000	155.000	195,000	80.000		1,300,000	600,000	18,000,000	3,300.000	100.000	6,450.000	30,460.000
	33.262.000	7,260,000	9.860.000	904.000	3,378.000	39.934,000	21.827.000	85,866,000	4.196,000	2,541,000	7.055.000	216,083.000

The above table has been compiled from various sources, and is believed to be as reliable as any published. Absolute accuracy cannot be claimed, for the figures of yearly production have always been little better than estimates; the inconstancy of oil wells, the fluctuations in the tide of developments, and the careless habits of the average oil producer, make the systematic collection of reliable statistics impossible. The yearly output from the whole oil region may be closely calculated, but the detailed production of districts can only be estimated approximately. As there is confessedly so much uncertainty in the primary data, it would be pretentious to employ other than round numbers in the totals. We have made no account of anything below 1.000 barrels, and this amount is so small that it cannot be shown to scale on the chart: consequently some of the districts or divisions are not designated by their colors on the chart until several years after they commenced to produce oil.

Adjustment Table.

It is evident that stocks in the oil regions are increased or decreased by exactly so many barrels, as production exceeds or falls below shipments out of the region. Having used certain figures on the chart to represent production, and assuming that reports of stocks are reliable, we find it necessary, for the sake of consistency, to correct the shipments, as shown below.

This method of adjustment throws all errors into the shipments. In some cases, perhaps, the production should have been increased or the stocks diminished. We give the figures, the reader can adjust to suit himself.

YEARS.	Stocks as given in Stowell's Reporter.	Stocks increased (+) or diminished (—) during the year.	Production as given on chart.	Shipments if production and stocks are correct.	Shipments as given in Stowell's Reporter.	Stowell's shipments too high (+) or too low (—).
1869,	340,154	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .
1870,	554,626	+214,472	5,371,000	5,156,528	5,235,931	+79,403
1871,	532,000	—22,626	5,531,000	5,553,626	5,664,791	+111,165
1872,	1,084,423	+552,423	6,357,000	5,804,577	5,899,947	+95,370
1873,	1,625,157	+540,734	9,932,266	9,391,266	9,499,775	+108,509
1874,	3,705,639	+2,080,482	10,883,000	8,802,518	8,821,500	+18,982
1875,	3,550,200	—155,439	8,801,000	8,956,439	8,924,938	—31,501
1876.	2,824,739	—725,461	9,015,000	9,740,461	10,164,452	+423,991
1877,	3,127,837	+303,098	13,043,000	12,739,902	12,832,373	+92,471
1878,	4,615,299	+1,487,462	15,367,000	13,879,538	13,676,004	—203,534
1879,	8,470,490	+3,855,191	19,827,000	15,971,809	15,886,470	—85,339
1880,	18,928,430	+10,457,940	26,048,000	15,590,060	15,677,492	+87,432
1881,	26,119,704	+7,091,274	27,238,000	20,146,726	20,284,235	+137,509
1882,	34,596,612	+8,576,908	30,460,000	21,883,092	21,878,314	—4,778
Totals,	. . . . .	. . . . .	187,873,000	153,616,542	154,446,222	. . . . .

Total production prior to 1870; Table 1, . 28,210,000 bbls.
Total production in adjustment table, . . 187,873,000 "

Total production, 1859 to 1882, inclusive, . 216,083,000 "

From 1859 to 1870, the shipments must have equaled the production, less the 340,154 barrels remaining in stock December 31, 1869. Consequently we have:
Total shipments prior to 1870; Table 1, . 27,869,846 bbls.
Total shipments in adjustment table, . . 153,616,542 "

Total shipments, 1859 to 1882, inclusive, . 181,486,388 "

Geographical Range of the Several Divisions, with Names and Dates of Pioneer Wells.

Oil Creek Division.—Oil Creek Valley and borders, Cherry Run, Keech Farm, West Pithole, Pleasantville and surroundings, Enterprise, Shamburg, Octave, Titusville and Church Run. Commenced producing—August 28, 1859, from Drake well, near Titusville; well 69½ feet deep; production about ten barrels per day.

Central Allegheny Division.—Allegheny River, from Scrubgrass to East Hickory, including East Sandy, Bully Hill, Franklin, Reno, Slate Run, Walnut Bend, Henry's Bend and mouth of West Hickory. Commenced producing—In fall of 1860, Evans well and others at Franklin.

Tidioute Division.—Tidioute, Economy, Dennis Run, Triumph, New London, Colorado and Fagundus. Commenced producing—In fall of 1860, Island well, at Tidioute; Economy well "A," or flowing well, struck Dec. 25, 1860.

Beaver Division.—Smith's Ferry, Ohioville and Slippery Rock. Commenced producing—December, 1860, Patten, Finlen, Swan & Co.'s well; oil at 180 feet.

Pithole Division.—Holmden, Morey, Ball and Rooker farms and the Cashup pool. Commenced producing—January 7, 1865, United States Oil Company's "Frazer Well."

Butler and Armstrong Division.—Embracing all the oil territory in these two counties. Commenced producing—October, 1865, Tom's Run well, near Parkers; January 3,

1866, Brady's Bend well, No. 1; March 23, 1878, Troutman well, at Modoc.

Clarion Division.—Foxburg, Richey Run, Emlenton, St. Petersburg, Edenburg and Shippensville. Commenced producing—In 1866; name of first well not ascertained.

Bradford Division.—The "Northern Oil Field" of McKean county, Penna., and Cattaraugus county, N. Y. Commenced producing.—In summer of 1868, Moses well, No. 3, about five barrels; November, 1871, Foster Oil Company's well, No. 1, about ten barrels; December, 1874, Butt's well, No. 1, about seventy barrels; summer of 1875, Olmstead well.

Warren and Forest Division.—Warren, Stoneham, Clarendon, Cherry Grove and Sheffield, in Warren county, and Balltown, Blue Jay and Cooper districts, in Forest county. Commenced producing—March, 1875, Beatty well, No. 1, at East Warren; April, 1877, Grandin & Berry, No. 1, at Balltown; summer of 1877, Huling's well, Blue Jay district; January 12, 1878, Tolles, No. 1, Stoneham; June 24, 1880, Eagan, No. 1, Clarendon; April, 1881, Magee & Horton, No. 1, south of Sheffield; May 17, 1882, "The Mystery," Cherry Grove; September 15, 1882, Shannon well, No. 1, Cooper tract.

Bullion Division.—Bullion Run and its surroundings in Venango county. Commenced producing—May, 1876, Phillips Bros. well, No. 1.

Allegany County Division.—Richburg, Boliver, Genesee, Alma, etc., in Allegany county, New York. Commenced producing—June, 1879, Triangle well, No. 2, about four barrels; July, 1880, Triangle, No. 3, about fifteen barrels; May, 1881, Richburg, No. 1, about thirty-five barrels.

The second edition of Chart No. 1 was issued with the annual report of 1886, and contained the following notes in addition to those already given:

Production Table No. 2.

YEARS.	Venango and Butler (Proper.)	Baldridge and Thorn Creek.	Cogley Run.	Warren and Clarendon.	Cherry Grove.	Cooper.	Balltown.	Wardwell.	Bradford.	Allegany, N. Y.	Totals.
1882,*	118,966,000	. . . . .	. . . . .	1,818,036	2,345,400	29,864	2,700	. . . . .	85,866,000	7,055,000	216,083,000
1883, ...	2,700,000	. . . . .	. . . . .	872,686	755,512	1,095,558	776,244	. . . . .	13,400,000	4,700,000	24,300,000
1884, ...	2,687,200	962,800	. . . . .	1,221,477	264,942	1,004,849	807,506	701,226	12,000,000	3,850,000	23,500,000
1885, ...	2,785,980	1,813,020	701,000	1,426,363	135,809	340,924	348,098	148,806	10,600,000	2,600,000	20,900,000
Totals, ...	127,139,180	2,775,820	701,000	5,338,562	3,501,663	2,471,195	1,934,548	850,032	121,866,000	18,205,000	284,783,000

* Figures opposite 1882 indicate total production up to end of 1882.

Total Production, Shipments and Stocks.

Years.	Production.	Shipments.	Stocks.
Table No. 1, ...	216,083,000	181,486,388	34,596,612
1883, ...	24,300,000	22,096,612	36,800,000
1884, ...	23,500,000	23,500,000	36,800,000
1885, ...	20,900,000	23,900,000	33,800,000
Totals, ...	284,783,000	250,983,000	33,800,000

Notes.

1. This chart is partly a reprint of the one accompanying report I[4], and all the figures prior to January 1, 1883, remain unchanged. The years 1883, 1884 and 1885 are now added to continue the statistical history down to January 1, 1886.

2. All available data have been carefully examined and weighed, and it is believed that the chart is as nearly correct as it is possible to make one.

3. The production in 1885 is represented a trifle greater than the estimates of the *Petroleum Age* and others, the shipments a little larger than the totals of pipe line reports, and the stocks a few thousand barrels less. This slight adjustment of the statements and estimates of pipe lines and field men harmonizes all factors.

4. Since 1881 the production of the Warren and Forest division has been divided into the productions of the respective oil districts composing this division. These separate productions are indicated by line shading within the colored band, indicating the total production of the entire division:

The basis of table No. 1, may be found in the *Petroleum Age*,[5] June, 1882, but corrections have been made where errors were evident. The *Age* gives no authority for its figures, but they appear to have been based on a similar table published in *Stowell's Petroleum Reporter*, in May, 1881, altered in some cases to suit the compiler's views. Both contain typographical errors which have been copied

unnoticed, and both, in the main, take the *Herald's* report for the earlier years.

Stowell's table, the original of which I have examined, was prepared in Titusville, in 1881, by a gentleman of large experience in the oil business and at the request of the leading oil companies of the time. The design was to put on record reliable estimates of production during the preceding ten or twelve years, and to this end the figures were submitted for correction to the oil companies which were conversant with operations in the several fields, and after full discussion and adjustment they were accepted by them as the nearest possible approximation to the truth, in the absence of any systematic or authoritative statistics on the subject.

Chart No. 2

Was prepared for the annual report of 1886, for the purpose of showing comparatively, by scale, the relative productions of the "white sand" and "black sand" fields; the latter embracing the districts of Bradford and Allegany, the former, everything south of McKean county, including the production from the Warren and Forest sands. It covers a period of ten years prior to the first of January 1886, and shows the average daily production of each division for every month in the years named; the average yearly production and shipments during each year; and the number of new wells completed monthly.

As the design of this chart demanded definite monthly averages of production, which had to be selected from some of the tables given by authorities on statistics, and as Chart No. 1 had already been prepared, based on what appeared to be the most reliable selection of figures and estimates from various sources, the result being given in round numbers, it is not to be supposed that the two will agree in all of their details, still no important discrepancies appear on comparison of the totals.

The shipments and stocks on the two charts are identical.

Authorities for the daily averages used, 1876–77–78,

79–80–81.—Total production of all fields taken from *Stowell's Petroleum Reporter* (See table in January number, 1886). Daily averages of Bradford and Allegany from the same publication, as given currently each month ; the figures for 1880, having been corrected as explained in *Reporter*, January, 1881.

1882.—This year the various reports were so conflicting that estimates were made and the results given in round number.

1883–84–85.—See table published in *Petroleum Age*, January, 1886, page 1223. These are estimated productions obtained by correcting the pipe line runs by the increase or decrease of stocks remaining at the wells at the close of each month. This method gives more uniform results from month to month than the pipe line runs, but does not materially alter the totals for the year. The figures used on chart correct several typographical errors which have crept into the table.

Chart No. 3.

This is a reprint of No. 2 with a vertical line introduced to represent stocks, and the statistics of 1886, 1887 and 1888 added.

The monthly averages for production in 1886 and 1887 are from table in *Petroleum Age*, December, 1887, page 1814; the shipments and stocks from pipe line reports.

All the figures for 1888 are taken from pipe line reports and are known to be reliable. The daily averages in 1888 are pipe line runs and not estimated production.

The production, shipments and stocks for the last three years are tabulated below :

Table No. 3.

YEARS.	PRODUCTION.				Shipments.	Stocks, Dec. 31.
	White sand.	Bradford.	Allegany.	Total.		
1886, ...	13,066,740	9,752,797	2,260,923	25,080,460	25,890,000	32,990,460
1887, ...	12,396,061	7,580,979	1,309,520	21,286,560	26,280,000	27,997,020
1888, ...	9,820,518	5,306,062	*1,000,000	16,126,580	25,850,000	18,273,600
Totals, . . .	25,282,319	22,639,838	4,570,443	62,493,600	78,020,000	18,273,600

*Bradford and Allegany are not given separately on the Chart; this is an estimated production.

Total white sand production 1886, 1887, 1888, ... 35,283,319 barrels.
Total black sand production 1886, 1887, 1888, ... 27,210,281 "

62,493,600 "

To be exact, the black sand production should be increased by whatever quantity the Kane and Elk pools have produced. But in the current reports these fields are generally included in the white sand division, and not being able to separate them satisfactorily I have left them there.

Summary of Total Production, 1859 to 1889.

	WHITE SANDS.		BLACK SANDS.		Total.
	Venango, Butler, etc.	Warren & Forest.	Bradford.	Allegany.	
1859–1882, Table 1	118,966,000	4,196,000	85,866,000	7,055,000	216,083,000
1883–1885, " 2	11,650,000	9,900,000	36,000,000	11,150,000	68,700,000
1886–1888, " 3	*35,283,319	. . . . .	22,639,838	4,570,443	62,493,600
Totals, ...	165,899,319	14,096,000	144,505,838	22,775,443	347,276,600

*Including Warren and Forest.

Total white sand production, ... 179,995,319 barrels.
Total black sand production, ... 167,281,281 "

Grand total, ... 347,276,600 "

These figures are obtained by using the tables given on Chart No. 1, where round numbers only are employed (see

Table No. 4) which are 362,460 barrels in excess of the more exact figures on Chart No. 3. Deducting this excess, we have 346,914,140 barrels as the accepted total production of the whole region up to January 1, 1889.

This sum total may be divided between the black sands and white sands as follows :

1859-1875, white sands, Table No. 1, . . .	75,049,000	
1876-1888, " " " " 5, . . .	105,363,140	
		180,412,140
1859-1875, black sands, Table No. 1, . . .	36,000	
1876-1888, " " " " 5, . . .	166,466,000	
		166,502,000
Total, ...		346,914,140

Which agrees with Table No. 7, where all the figures are brought together for convenient reference.

Table No. 4. Production, Shipments and Stocks.

(Figures used on Chart No. 3.)

	Production resulting from daily averages as given on Chart 3.	Corrections to agree with Chart 1.	Production Chart No. 1.	Shipments.	Stocks.
1876, . . .	8,968,906	+46,094	9,015,000	9,740,461	2,824,739
1877, . . .	13,135,671	—92,671	13,043,000	12,739,902	3,127,837
1878, . . .	15,163,462	+203,538	15,367,000	13,879,538	4,615,299
1879, . . .	19,741,661	+85,339	19,827,000	15,971,809	8,470,490
1880, . . .	26,029,631	+18,369	26,048,000	15,590,060	18,928,430
1881, . . .	27,376,509	—138,509	27,238,000	20,146,726	26,019,704
1882, . . .	30,467,000	—7,000	30,460,000	21,883,092	34,596,612
1883, . . .	24,226,864	+73,136	24,300,000	22,096,612	36,800,000
1884, . . .	23,333,844	+166,156	23,500,000	23,500,000	36,800,000
1885, . . .	20,891,992	+8,008	20,900,000	23,900,000	33,800,000
1886, . . .	25,080,460	. . . . .	. . . . .	25,890,000	32,990,460
1887, . . .	21,286,560	. . . . .	. . . . .	26,280,000	27,997,020
1888, . . .	16,126,580	. . . . .	. . . . .	25,850,000	18,273,600
	271,829,140	+362,460	. . . . .	257,468,200	. . . . .

It will be seen from the above that the disagreement between the two charts amounts to 362,460 barrels or an average of 99 barrels per day for the time covered ; a small dif ference when the various sources from which the data have been collected are considered. The Bradford and Allegany

production, however, does not compare so closely, the averages on Chart No. 2, making a total of 779,281 barrels (213 barrels per day), less than the totals of No. 1.

On the comparative diagram, page plate No. 1, the production, shipments and stocks, as recorded in table No. 4, are represented by scale, each vertical inch standing for 10,000,000 barrels of oil.

Presented in this way the fluctuations of production, the steady increase of shipments and the great accumulation of stocks in 1883, followed by their rapid reduction in 1887 and 1888, are graphically shown.

It will be noticed that the stocks at the close of 1880 stand a trifle higher than at the close of 1888. Hence it is evident that the production of the last eight years has hardly been of sufficient volume to satisfy the current demands of consumption during that time.

At the close of 1880 Bradford alone was furnishing fully 85 per cent. of the production of the entire region, and had not yet reached its zenith. Since then it has produced 98,652,918 barrels of oil, and meantime the following new fields have been discovered and pretty thoroughly drilled, some of them almost to depletion: Allegany, N. Y., Clarendon, Wardwell, Glade, Kinzua, Cherry Grove, Balltown, Cooper, Kane, Grand Valley, Tipperary, Tar Kill, Hall's Run, Red Valley, Cogley, Pontius, Hickey, Baldridge, Thorn Creek, Reibold, Glade Run, Brush Creek, Saxonburg, Bakerstown, Shannopin, Washington, Taylorstown, and several others. The total consumption during these eight years was 205,136,490 barrels, and as Bradford yielded 48 per cent. of this amount, all the other old fields with these many new and prolific pools added to them, could only have supplied the remaining 52 per cent.

It may also be noticed that the production of 1878 was only a little less than that of 1888. After ten years of development in very prolific fields, during which time 28,686 new wells were drilled, we find the average output about the same as it was at the beginning of the period.

In 1878 production exceeded shipments, in 1888 shipments largely exceed production, and were it not for the stocks

on hand, which are due to overproduction prior to 1880 (for since then we have consumed all that has been produced). Pennsylvania and New York would be unable at the present time to furnish more than about 70 per cent. of the daily shipments, as seen from the reports for January, 1889, which were as follows: Average daily runs, 53,496 barrels; average daily shipments, 76,812 barrels.

These facts speak for themselves, they need no comments.

Table No. 5.

Showing the gross annual production from both the black sand and the white sand districts, as calculated from the monthly averages seen on Chart No. 3.

	Bradford.'	Allegany.	Total Bradford and Allegany.	Total White Sand.	Total all fields.
1876, . . .	382,768	. . . . .	382,768	8,586,138	8,968,906
1877, . . .	1,468,481	. . . . .	1,468,481	11,667,190	13,135,671
1878, . . .	6,208,746	. . . . .	6,208,746	8,954,716	15,163,462
1879, . . .	13,914,509	. . . . .	13,914,509	5,827,152	19,741,661
1880, . . .	22,212,000	. . . . .	22,212,000	3,817,631	26,029,631
1881, . . .	22,945,069	681,509	23,626,578	3,749,931	27,376,509
1882, . . .	17,959,000	6,519,000	24,478,000	5,989,000	30,467,000
1883, . . .	13,294,886	4,746,175	18,041,061	6,185,803	24,226,864
1884, . . .	11,883,000	3,866,452	15,749,452	7,584,392	23,333,844
1885, . . .	10,564,298	2,609,826	13,174,124	7,717,868	20,891,992
1886, . . .	9,752,797	2,260,923	12,013,720	13,066,740	25,080,460
1887, . . .	7,580,979	1,309,520	8,890,499	12,396,061	21,286,560
1888, . . .	5,306,062	1,000,000	6,306,062	9,820,518	16,126,580
	143,472,595	22,993,405	166,466,000	105,363,140	271,829,140

Table No. 6.

Showing the average daily production during the years 1876 to 1888 inclusive. Calculated from the totals seen in Table No. 5.

	Bradford.	Allegany.	Total Bradford and Allegany.	Total White sands.	Total all fields.
1876, . . .	1,046	. . . . .	1,046	23,459	24,505
1877, . . .	4,023	. . . . .	4,023	31,965	35,988
1878, . . .	17,010	. . . . .	17,010	24,534	41,544
1879, . . .	38,122	. . . . .	38,122	15,965	54,087
1880, . . .	60,689	. . . . .	60,689	10,430	71,119
1881, . . .	62,863	1,867	64,730	10,274	75,004
1882, . . .	49,203	17,860	67,063	16,408	83,471
1883, . . .	36,424	13,003	49,427	16,948	66,375
1884, . . .	32,467	10,564	43,031	20,723	63,754
1885, . . .	28,943	7,150	36,093	21,145	57,238
1886, . . .	26,720	6,194	32,914	35,800	68,714
1887, . . .	20,770	3,588	24,358	33,961	58,319
1888, . . .	14,498	2,732	17,230	26,832	44,062

The relative proportions of the black and white sand productions, as shown on Chart No. 3, are not easily measured by the eye in consequence of the irregular shapes assumed by the spaces representing the white sand. To remedy this and place the facts in a desirable shape for comparisons, we have prepared a supplemental diagram (page plate No. 2), constructed from table No. 5, and consequently agreeing with Chart No. 3. On this diagram only the yearly totals are employed, and as the measurements for both divisions are scaled upwards from one and the same base line, the relative proportions of each are seen at a glance.

The figures at the bottom, on the line lettered C, show what percentage of wells drilled each year proved to be dry, and it is interesting to note how this percentage falls and rises with the fall and rise of white sand production showing that these sands are the most unreliable. The high percentages of the last two years are suggestive, as indicating that a scarcity of good territory to work upon has forced operators to take an unusual number of ventures in uncertain locations.

Two of the most instructive lessons of the diagram are

these : During the thirteen years illustrated, the great black sand fields have grown to enormous proportions and fallen back to a level of third year. The white sands have failed to mantain an average output equaling their first year's production notwithstanding the many rich pools that have been discovered and depleted. The actual figures are: white sand production, 1876—8,586,138 barrels ; average yearly production for thirteen years, 8,104,857 barrels.

Previous to 1876, all the production may be accredited to the white sands. A few wells had been drilled near Bradford, but were considered of little or no importance.

In 1873, 1874 and 1875, Butler and Clarion were the great fields of activity and reach their maximum output of 9,100,000, in 1874, in which year the total production of all fields was about 770,000 barrels greater than in 1876, when this diagram commences. In 1887 Butler and Clarion had an output of 8,500,000 barrels, and this year marks the highest point of white sand production anterior to 1886.

In 1878 Bradford began to assert itself, the old fields commenced to decline and continued on the down grade until 1882, when Bradford and Allegany reached their maximum and the discovery of phenomenally large wells in Cherry Grove, Warren county, again directed attention to the white sands. From 1882 to the present time Bradford and Allegany have been declining and new territory in the middle and southern districts has been in demand.

The white sand production of 1882 was sustained and somewhat increased during 1883, 1884 and 1885 by the discovery of several important pools—Balltown, Cooper, Baldridge Thorn Creek, Cogley Run, Red Valley, etc.,—and in 1886, still more largely augmented by Kane, Grand Valley, Tarkill, Pontins, Shannopin, Washington and others. But in 1887 and 1888, notwithstanding these new acquisitions and the discovery of several more pools, the average production steadily declined and we find the white sand output of 1888 a little less than that of 1877.

The aggregate production represented on plate No. 2, is white sands, 105,363,140 barrels ; black sands, 166,466,000 barrels ; total, 271,829,140 barrels.

Table No. 7.

Showing the gross annual production for thirty years. Agreeing with the figures used on Chart No. 1 and Chart No. 3.

YEARS.	White sands.	Black sands.	Total all fields.
1859,	2,000		2,000
1860,	200,000		200,000
1861,	2,110,000		2,110,000
1862,	3,055,000		3,055,000
1863,	2,610,000		2,610,000
1864,	2,130,000		2,130,000
1865,	2,721,000		2,721,000
1866,	3,732,000		3,732,000
1867,	3,583,000		3,583,000
1868,	3,715,000	1,000	3,716,000
1869,	4,350,000	1,000	4,351,000
1870,	5,370,000	1,000	5,371,000
1871,	5,530,000	1,000	5,531,000
1872,	6,355,000	2,000	6,357,000
1873,	9,930,000	2,000	9,932,000
1874,	10,880,000	3,000	10,883,000
1875,	8,776,000	25,000	8,801,000
1876,	8,586,138	382,768	8,968,906
1877,	11,667,190	1,468,481	13,135,671
1878,	8,954,716	6,208,746	15,163,462
1879,	5,827,152	13,914,509	19,741,661
1880,	3,817,631	22,212,000	26,029,631
1881,	3,749,931	23,626,578	27,376,509
1882,	5,989,000	24,478,000	30,467,000
1883,	6,185,803	18,041,061	24,226,864
1884,	7,584,392	15,749,452	23,333,844
1885,	7,717,868	13,174,124	20,891,992
1886,	13,066,740	12,013,720	25,080,460
1887,	12,396,061	8,890,499	21,286,560
1888,	9,820,518	6,306,062	16,126,580
	180,412,140	166,502,000	346,914,140

Table No. 8.

Average daily production for thirty years, resulting from the totals given in Table No. 7.

	White Sands.	Black Sands.	Total.
1859, 125 days,	16		16
1860,	546		546
1861,	5,781		5,781
1862,	8,370		8,370
1863,	7,151		7,151
1664,	5,820		5,820
1865,	7,455		7,455
1866,	10,225		10,225
1867,	9,816		9,816
1868,	10,150	3	10,153
1869,	11,918	3	11,921
1870,	14,712	3	14,715
1871,	15,151	3	15,154
1872,	17,363	6	17,369
1873,	27,206	6	27,212
1874,	29,808	8	29,816
1875,	24,044	69	24,113
1876,	23,459	1,046	24,505
1877,	31,965	4,023	35,988
1878,	24,534	17,010	41,544
1879,	15,965	38,122	54,087
1880,	10,430	60,689	71,119
1881,	10,274	64,730	75,004
1882,	16,408	67,063	83,471
1883,	16,948	49,427	66,375
1884,	20,723	43,031	63,754
1885,	21,145	36,093	57,238
1886,	35,800	32,914	68,714
1887,	33,961	24,358	58,319
1888,	26,832	17,230	44,062

Table No. 9—Average daily pipe-line runs from White Sand Pools for each month of the year 1886.

	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Cherry Grove,	306	305	353	347	338	344	346	300	256	249	232	204
Balltown,	1,063	1,056	1,059	833	1,376	1,104	1,161	800	913	667	688	668
Cooper,	623	571	653	583	591	605	582	558	482	495	417	461
Tarkill,	....	..	427	764	915	1,262	4,038	3,756	2,258	1,831	1,784	1,550
Tipperary,	....	....	....	....	....	....	....	....	....	154	205	172
Red Valley,	....	....	....	....	1,260	1,181	1,039	940	899	778	782	675
Pontius,	....	....	....	....	....	2,350	2,273	2,752	2,804	2,928	2,765	2,472
Balridge,	1,288	1,218	1,369	1,299	1.668	1,725	1,700	1,750	1,876	2,000	2,100	2,600
Smith's Ferry,	....	....	....	....	13	6	17	15	9	19	4	14
Shannopin,	....	....	....	....	231	272	746	1,209	2,093	4,401	3,570	3,031
Washington,	....	497	900	1,734	5,397	8,022	6,568	10,723	13 ,143	12,184	9,129	8,841

Table No. 10.—Average daily pipe-line runs from White Sand Pools for each month of the year 1887.

	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Cherry Grove,	196	248	190	263	207	255	175	210	209	184	137	154
Balltown,	526	639	650	627	555	554	548	515	616	548	266	288
Cooper,	458	403	509	459	423	378	395	405	383	395	198	233
Tarkill,	1,400	1,200	1,081	1,488	1,420	1,598	1,086	973	937	881	628	687
Tipperary,	179	192	152	164	145	156	132	119	121	114	118	
Red Valley,	632	572	606	542	573	509	461	429	353	375	299	307
Pontius,	2,313	2,057	1,950	1,752	1,839	1,787	1,610	1,481	1,294	1,359	923	996
Baldrige,	2,800	6,025	5,500	6,055	6,151	6,259	6,169	5,242	7,691	7,995	1,456	1,567
Smith's Ferry,	11	12	9	15	9	9	8	6	6	6	21	14
Shannopin,	2,250	2,045	3,229	2,860	2,287	1,784	1,652	1,684	1,348	1,318	913	838
Washington,	6,930	6,318	6,322	7,429	7,734	7,497	8,637	8,536	9,150	6,740	4,650	5,377

Table No. 11.—Average daily pipe-line runs from White Sand Pools for each month of the year 1888.

	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Cherry Grove,	125	174	144	160	122	166	132	156	161	160	164	169
Balltown,	226	266	237	296	267	272	237	194	200	237	366	347
Cooper,	271	360	265	289	255	292	295	207	214	278	249	299
Tarkill and Tipperary,	609	681	599	614	199	215	179	175	181	189	164	153
Red Valley,	219	271	252	225	268	258	237	222	230	162	198	180
Pontius,	1,048	1,050	979	946	916	882	887	954	986	1,090	1,168	1,080
Baldridge,	1,546	1,793	2,095	2,751	2,713	2,895	2,855	3,651	3,773	3,212	3,274	3,188
Smith's Ferry,	12	10	14	18	15	15	9	12	12	0	10	10
Shannopin,	788	903	866	908	965	778	857	752	796	751	723	746
Washington,	4,734	4,995	5,855	5,441	7,311	7,901	6,672	6,068	6,359	5,392	6,038	7,126
Mount Morris,	....	....	....	....	....	162	123	199	216	612	659	729
Brush Creek,	....	....	....	....	....	....	136	165	187	165	181	435
Turkeyfoot,	....	....	....	....	....	....	....	....	....	....	14	19

Table No 12.—Total Production of White Sand Pools.

	1882.	1883.	1884.	1885.	1886.	1887.	1888.	Total.
Cherry Grove,	1,345,400	755,512	264,912	135,809	108,876	73,546	55,824	3,739,879
Balltown,	2,700	776,244	807,506	348,100	346,312	192,333	95,829	2,569,024
Cooper,	29,864	1,095,558	1,004,849	340,924	201,455	141,155	99,730	2,913,535
Tarkill and Tipperary,					559,564	377,221	120,162	1,056,947
Pontius,					560,780	588,370	365,484	1,514,634
Baldridge,			962,801	1,813,020	708,276	2,028,728	1,029,847	6,542,672
Shannopin,					483,338	690,500	299,812	1,473,650
Washington,				10,533	2,418,872	2,871,016	2,254,923	7,555,344
	2,377,964	2,627,314	3,040,068	2,648,386	5,387,473	6,962,869	4,321,611	27,365,685

Table No. 13.— Wells completed in 1887.

	Allegany.		Bradford.		Elk and Kane.		Warren and Forest.		Venango, Clarion, Butler.		Washington, Allegheny, Beaver, Greene.		Total productive.	Total, dry.	Total, drilled.
	Prod.	*Dry.*	*Prod.*	*Dry.*	*Prod.*	*Dry.*	*Prod.*	*Dry.*	*Prod.*	*Dry.*	*Prod.*	*Dry.*			
January, ...	4	0	12	3	5	3	27	4	47	20	27	7	122	37	159
February, ...	3	3	12	1	6	0	27	4	54	10	21	6	123	24	147
March, ...	6	2	7	2	2	1	23	6	38	28	13	5	89	44	133
April, ...	3	0	14	2	7	1	35	9	48	22	19	9	126	43	169
May, ...	2	1	13	2	8	1	45	10	34	21	8	1	110	36	146
June, ...	6	1	22	0	8	0	52	9	48	23	8	2	144	35	179
July, ...	0	2	20	1	4	1	37	6	59	24	7	1	127	35	162
August, ...	3	0	10	0	4	1	29	11	54	23	15	2	115	37	152
September, . . .	4	2	12	1	3	0	20	10	48	20	9	1	96	34	130
October, ...	2	1	0	3	6	5	19	8	54	12	4	0	85	29	114
November, ...	0	1	1	1	3	1	4	11	50	22	3	7	61	43	104
December, . . .	2	0	1	2	5	0	6	2	54	24	2	1	70	29	99
Totals, . . .	35	13	124	18	61	14	324	90	588	249	136	42	1,268	426	1,694

Total new production from these wells, 47,849 barrels per day.

Table No. 14.—Wells completed in 1888.

	Allegany.		Bradford.		Elk and Kane.		Warren and Forest.		Venango, Clarion, Butler.		Washington, Allegheny, Beaver, Greene.		Total, productive.	Total, dry.	Total, drilled.
	Prod.	*Dry.*	*Prod.*	*Dry.*	*Prod.*	*Dry.*	*Prod.*	*Dry.*	*Prod.*	*Dry.*	*Prod.*	*Dry.*			
January, ...	2	0	2	1	5	1	3	4	37	10	3	0	52	16	68
February, ...	0	0	1	0	1	0	0	2	25	16	4	7	31	25	56
March, ...	0	1	2	1	1	3	0	0	35	15	6	2	44	22	66
April, ...	0	0	1	0	0	0	3	3	15	14	7	6	26	23	49
May, ...	1	0	0	0	0	1	1	2	22	9	15	5	39	17	56
June, ...	2	2	1	0	1	0	2	4	40	10	18	7	64	23	87
July, ...	0	0	2	0	1	0	0	2	38	17	15	7	56	26	82
August, ...	1	1	0	0	2	1	0	0	40	16	16	19	59	37	96
September, . . .	4	0	2	1	1	0	10	1	83	7	14	9	114	18	132
October, ...	2	3	3	0	14	1	24	6	113	35	19	9	175	54	229
November, . . .	8	4	13	0	18	0	34	3	149	37	25	16	247	60	307
December, . . .	8	3	17	2	18	0	30	6	135	45	30	8	238	64	302
Totals, . . .	28	14	44	5	62	7	107	33	732	231	172	95	1,145	385	1,530

Total new productions from the wells, 29,531 barrels per day.

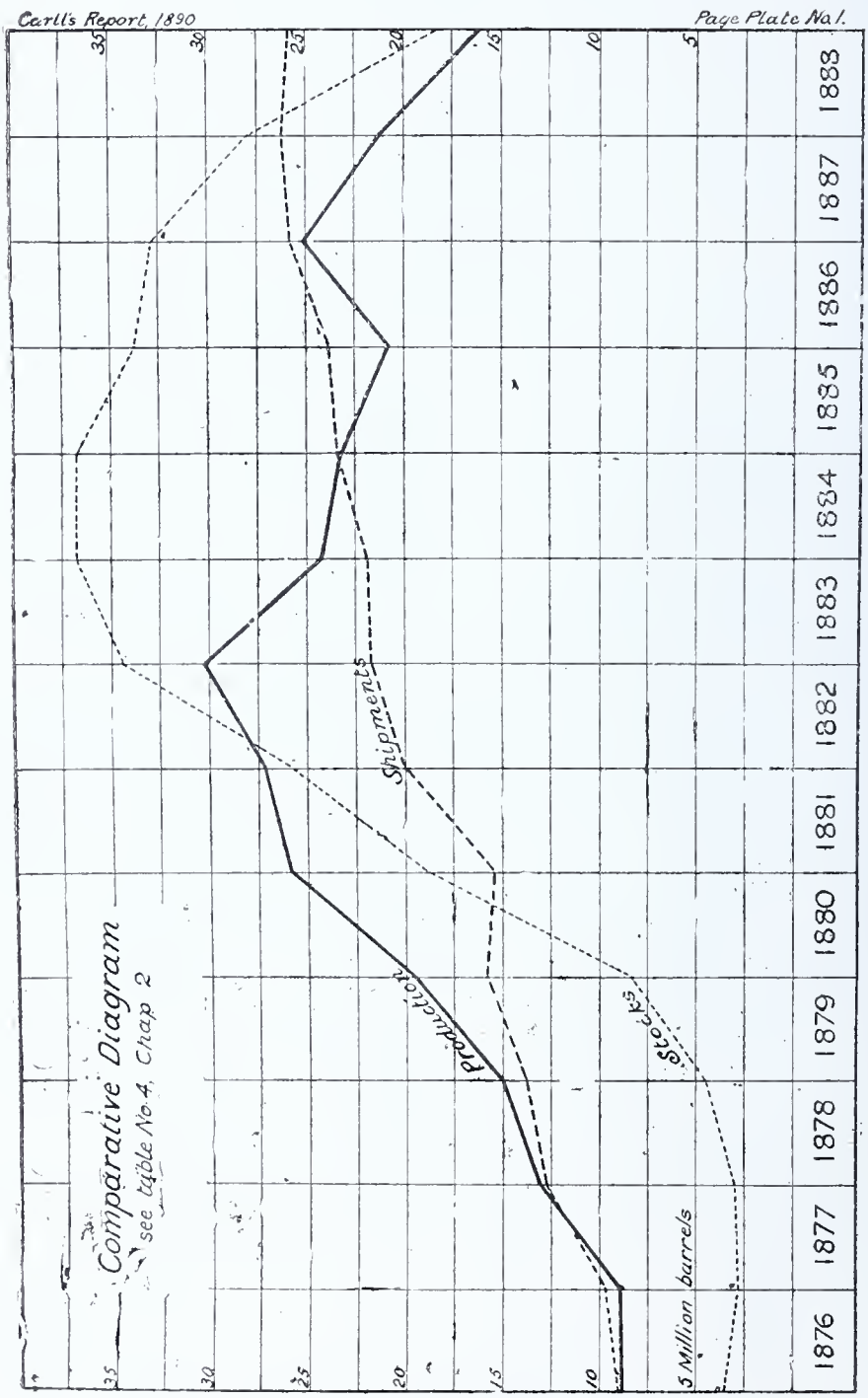
Table No. 15.—Number of wells completed in each month, 1876 to 1888.

[These figures were used in plotting the line representing completed wells on Chart No. 3.]

	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Wells Dry.	Total Drilled.
1876,	235	236	248	207	200	258	243	268	209	272	277	307	. .	2,960
	12	9	11	29	21	29	29	40	27	41	38	43	329	. . . .
1877,	279	244	292	279	314	406	335	253	327	461	483	383	. . .	4,056
	50	51	52	38	60	63	59	45	62	68	55	54	657	. . . .
1878,	276	220	212	319	472	272	204	188	173	229	265	158	. .	2,988
	46	36	39	34	41	23	26	10	24	23	19	12	333	. . . .
1879,	139	121	238	268	390	327	287	240	174	207	178	229	. . .	2,798
	16	5	19	13	17	10	11	6	8	13	13	10	141	. . . .
1880,	242	279	366	451	441	331	337	357	390	378	329	302	. .	4,203
	12	6	10	17	12	9	15	17	13	13	9	11	144	. . . .
1881,	220	199	274	325	406	364	340	333	302	312	365	408	. . .	3,848
	4	7	7	13	6	16	15	34	17	11	22	15	167	. . . .
1882,	336	342	384	437	439	330	185	250	171	117	149	123	. . .	3,263
	10	15	9	16	12	24	10	26	13	12	20	11	178	. . . .
1883,	125	131	146	215	285	231	260	309	325	321	329	272	. . .	2,949
	15	24	17	29	22	21	21	26	19	22	22	25	263	. . . .
1884,	229	227	265	298	311	268	164	145	89	60	73	66	. . .	2,195
	21	6	24	26	29	37	22	23	17	17	23	11	256	. . . .
1885,	64	62	82	116	185	242	217	283	320	397	384	329	. . .	2,681
	10	7	14	10	26	43	37	39	34	40	54	36	350	. . . .
1886,	265	265	296	353	351	372	358	328	253	279	216	189	. . .	3,525
	45	35	50	58	57	56	46	42	36	62	45	52	584	. .
1887,	159	147	133	169	146	179	162	152	130	114	104	99	. .	1,694
	37	24	44	43	36	35	35	37	34	29	43	29	426	. . . .
1888,	68	56	66	49	56	87	82	96	132	229	307	302	. . .	1,530
	16	25	22	23	17	23	26	37	18	54	60	64	385	. . . .

Wells drilled, 38,690; wells dry, 4,213; wells productive, 34,447.

Percentage of dry holes, $10\frac{1}{3}$.


Carll's Report, 1890
Page Plate No I.
Comparative Diagram
see table No 4, Chap 2
Production
Shipments
Stocks
5 Million barrels
35
30
25
20
15
10
5
1876
1877
1878
1879
1880
1881
1882
1883
1884
1885
1886
1887
1888

It would seem that no objection ought to lie against the plan of balancing production shipments and stocks, followed in the preceding pages. If a tank contains on the first of January 1,000 barrels of oil (representing stocks) received at different times during the year, 10,000 barrels (representing production) and delivers meantime 8,000 barrels (representing shipments) there should be 3,000 barrels of stocks remaining in it at the close of the year. But oil is not a stable article to handle or hold, there is more or less shrinkage and wastage both in stocks and oil in transit, and hence unless these were provided for a considerable shortage would be found at the end of the year.

To compensate for this loss the pipe lines deduct two per cent. from all oil run from the wells, and also buy oil as occasion may require, and turn it over to a sediment and surplus account which is held as a reserve to make up any deficiency that may occur by the deterioration of the large stocks carried from year to year and is a guarantee to the trade that they are able to deliver the full amount of merchantable oil represented by their certificates and credit balances. At the present time this surplus amounts to over 3,000,000 barrels, and as it has not been reduced in late years in proportion to the reduction of the stocks, it undoubtedly is more than sufficient for the purpose intended, and, therefore, we may rest assured the actual stocks at the close of 1888 were somewhat larger than the regular reports indicated.

The deliveries or shipments as currently reported are often quite unreliable, and in any case do not represent the actual consumption. The amount delivered by the several pipe lines can be accurately ascertained from their monthly statements, if the figures are intelligently handled, but some statisticians are careless, sometimes making omissions and at others including large amounts which merely passed from one line to another. In 1888 more than 500,000 barrels were added in this way to several of the published reports. Then, too, there is considerable oil shipped by private lines and in barrels to dumps and local refineries, which does not come into the ordinary totals. The actual consumption,

Carll's Report 1890 — Page Plate No. 2.

Total White sand production 105,383,140

Total Black sand production 166,466,000

Black sand production

White sand production

25 000 000
20 000 000
15 000 000
10 000 000
5 000 000
1

Barrels

	1876	1877	1878	1879	1880	1881	1882	1883	1884	1885	1886	1887	1888
Percentage of Dry Holes	11.11	16 20	11.15	5 04	3 42	4.34	5.45	8 92	11 66	13.05	16.56	24.14	25 16

that is the oil which vanishes from the oil regions, evidently includes all oil delivered by the leading pipe lines, by private lines and in barrels, oil destroyed by fire, the shrinkage on stocks, and wastage from every source.

The pipe line runs from the wells which are often taken to represent production also need correction. They show the quantity of oil received from the wells (less the two per cent. before mentioned), but, like the shipments, do not include the oil delivered in barrels and through private lines. Another element of uncertainty is this: there are thousands of tanks at the wells and these are not always drawn down to the same level at the first of every month when the pipe line runs are reported. The difference between the total amount of stocks at the wells at the beginning of the year and the total amount at the end of the year should be added to or taken from (as the case may be) the total amount of the runs in order to show the actual production of the wells connected with the lines.

But we may admit these inaccuracies of detail without discrediting the final results aimed at by a study of the statistics given. No doubt the stocks are accurately reported, and hence if in any year the production is rated too low, then the shipments are rated too low also, for their their relative proportions cannot be altered if the stocks be correct.

At any rate this fact is clear whatever may have been the actual production of the oil regions up to January 1, 1889. It has all been taken from the country or consumed, except the stocks now in store as shown on Chart 3. Therefore, for all the purposes of practical comparison and deduction it does not signify if the production has been five or even ten millions of barrels more or less than reported.

A word should be said in relation to the lists of completed wells here published. There can be no doubt that the full number recorded has been drilled, for they are reported monthly, with owners' names and the farms on which they are located. All the errors are errors of omission, and these amount to quite a sum every year. The field is large and many wells are quietly drilled and abandoned or become

small producers without attracting any attention outside of the immediate neighborhood in which they are located. In addition to these omitted oil wells, the list should be further increased by over five hundred wells which have been drilled for gas and not reported in the oil list.

Chapter III.

General Map of the Oil and Gas Fields; Plate No. 2.

A map of Western Pennsylvania accompanies this report. It is partly a reprint of one published in 1885, but has been corrected in many particulars and enlarged on the west and south, by additions from Ohio and West Virginia. The report closed with the year 1888, but an unavoidable delay in printing has made it possible to defer the completion of the map until July 1, 1889, and also affords an opportunity for inserting the following explanatory notes, and a number of records of wells which have been completed since January 1.

Oil and Gas Pools.

The map is intended to show the locations of all the oil and gas pools known at date. In the old fields the pools and belts are outlined with considerable precision, in the new a portion of the tracings are necessarily somewhat hypothetical. It would hardly be possible to trace the *exact* boundaries in every instance, and indeed, if they could be so traced, probably some new development would change the shape of the figure before the map could be published. In most cases the productive spots are outlined liberally. Very few of the white sand pools are productive in every part. They are generally made up of prolific streaks and spots separated by many acres of barren territory. Hence if the productive portions should be calculated by scaling the colored spots on the map, the number of square miles obtained would be largely in excess of the area which is actually productive.

The limited areas of the colored spots as compared with the uncolored portions surrounding them, very naturally

suggests the inquiry. Have these uncolored portions been tested by the drill, or do they still remain as promising fields for future exploration ?"

To this we may answer that the country to the northwest and west of the great chain of productive pools has been sufficiently drilled to dispel all reasonable hope of finding important extensions of the oil rocks of either the McKean, Warren or Venango-Butler groups in that direction; the southwesterly and easterly limit of the chain seems to be almost as certainly defined; in the central portion of the belt, the spaces between the pools have been quite thoroughly drilled in almost every direction in efforts to connect one pool with another or to discover something new. Still there is ample room within the proven lines of possible production, for many more oil and gas pools of limited extent, particularly in the southern districts, where the pools are very prolific, and no doubt many more will yet be found. There is also a possibility that deep drilling and wide-spread prospecting may lead to the discovery of new productive horizons in some parts of the field.

Outcrop Lines and Anticlinals.

In the southwestern part of Greene county the Olean Sharon conglomerate lies about 2,800′ beneath the surface: but rising towards the northwest at an average rate of nearly twenty feet to the mile, it gradually approaches the surface, comes up to water level in the Allegheny River near Red Bank, and rises to the tops of the highest ridges in McKean county, at an altitude of about 2,350′ above ocean level.

Of course all the overlying rocks rise in a similar manner, and one layer after another comes to the surface in regular succession. First the upper beds outcrop and disappear, then the middle, then the lower.

For the purpose of showing the northerly limits of some of these formations, the approximate geographical ranges of a few important outcrops have been traced on the map, as follows:

Pittsburgh Coal Bed. The great irregularity of this out-

crop is due to the influence of the important anticlinals which traverse this region.

Ferriferous Limestone. This rock varying in thickness from 5′ to 20′, appears to have its best development in Butler county. Along its outcrop it has shrunken materially and when traced underground in the direction of the broken line curving south and west on the map, it thins out and runs into a bed of dark sandy shale so unlike the massive limestone of Butler county, that the driller does not even recognize its horizon.

Mahoning Sandstone. A broad belt of elevated sandy country marks this outcrop. This is the so-called third sand of the Dunkard Creek region of Greene county, supposed by many of the early operators to be the equivalent of the third sand of Oil Creek.

Olean Conglomerate. Only a few isolated outliers of this rock are found north of the line of outcrop indicated on the map and therefore the line defines the extreme northerly limit of all possible coal fields in this part of the state.

The *Chestnut Ridge*, *Laurel Hill* and *Nolo* anticlinals are approximately located on the map for the purpose of showing where the great folds of the mountains commence.

Oil Pools.

As the oil and gas pools are now so numerous that they could only be referred to by name on the map, the lists are repeated here for the purpose of adding some explanatory notes which seem to be required.

"*Unimportant*" indicates that sufficient developments have been made to warrant the conclusion that no large production need be expected in that locality.

"*Gleaning*" indicates that small wells are still pumping and new ones of small capacity are being drilled in the field. This process will go on for many years.

Northeastern Oil Fields, "Black Sands."
Devonian, No. VIII.

Oil sands fine-grained, friable and occasionally containing some pin-head pebbles. Color, black, dark-brown, choco-

late-brown, and brownish-gray. Drillings popularly spoken of as resembling coffee grounds, chocolate, or brownish coal ashes. Oil dark-amber, amber, green, occasionally black. Gravity ranging from 36° to 49°.

No. 1. *Allegany District, New York.*—Composed of the Central Richburg field and outlying pools of Clarksville, Niles, Wirt, Harding & O'Conner, and Waugh & Porter; the last named producing an amber oil of 40° gravity, while just north of Richburg a few wells produced a very black oil of 35° gravity.

No. 2. *Bradford District.*—Productive everywhere within the limits outlined. In some localities produces from several horizons, but the great reservoir is the Bradford sand, which varies in thickness from 30′ to 100′ and sometimes encloses shaly beds between its productive members.

No. 3. *Bradford-Kinzua Pool.*—An outlier of the Bradford field, which has furnished some remarkably productive and long-lived wells.

No. 4. *Smethport Pool.*—Only two or three very small wells. The oil is amber color, of rather heavy gravity and comes from a brown sand lying apparently about 350 feet below the Bradford sand.

No. 5. *Kane Pool.*—Discovered November, 1885. Oil from a brown sand lying several hundred feet below the Bradford sand. See report 1886, page 620.

No. 6. *Wilcox Pool.*—The first well was drilled here 1864 (?) (see I⁴, page 104), producing some oil and much gas. Other wells were drilled later, resulting in the development of a very prolific gas field and finally, in 1887 and 1888, a number of good oil wells were obtained. The Bradford sand is the principal oil horizon, but two other brown sands lie below it at intervals of about 100′ and 200′ and contain gas under very strong pressures.

No. 7. *Elk county.*—Came into prominence early in 1887. Oil derived from brown sands lying below the Bradford sand horizon. The Elk county oil group may be said to include the Smethport, Wilcox (lower sands), Kane and Elk sands, or all the brown sands that are found within

the first 400 feet after drilling through the horizon of the Bradford sand.

Middle Oil Fields, "White and Gray sands."

Devonian, No. VIII.

Oil sands generally grayish and fine-grained, but some times white, coarse-grained and pebbly in streaks.

Oils amber; ranging from dark-amber to light and varying in gravity from 35° to 50°.

No. 8. *Kinzua.*—Opened in summer of 1885. Some large wells flowing from 500 to 800 barrels per day for a short time.

No. 9. *Sugar Run.*—Small wells, uncertain territory. Oil from so-called Second sand. Unimportant.

No. 10. *Dew Drop.*—A small cluster of old wells with comparatively little production. Unimportant.

No. 11. *Warren and North Warren.*—Developed in 1875. Little new work being done. Unimportant.

No. 12. *Clarendon, Wardwell, etc.*—This includes the Clarendon, Stoneham, Stone Hill, Glade, Wardwell and Tiona developments. There are dry streaks within its outlines, but it is practically all one field, and contains a large number of small but profitable wells, as most of them still flow naturally and with very little expense to the operator. Active developments commenced in 1880.

No. 13. *Cherry Grove.*—Discovered May, 1882. Remarkable for large, but short-lived wells. The pool is now almost depleted and produces only about 150 barrels per day.

No. 14. *Balltown.*—Active developments commenced in the summer of 1882. Now thoroughly developed and daily production about 350 barrels.

No. 15. *Cooper.*—Opened in September, 1882. Large wells and prolific pool. Now producing about 300 barrels per day.

No. 16. *Wolf Creek.*—Indicated by the Hoodoo well in 1883, but not yet very satisfactorily developed. A few small wells which give promise that larger deposits may be found in the vicinity.

Southeastern Oil Fields, Venango, Butler sands. Catskill, No. IX.

White, yellowish and grayish sandstones, generally friable and coarse-grained and frequently a conglomerate mass of quartz pebbles from one-eighth of an inch to an inch in diameter, well water-worn and flattened.

Oils in the northern district generally green to black, in the southern generally amber and sometimes very light colored. Gravities range from 32° to 52°—the green and black oils weighing about 48°.

No. 17. *Eldred*, or Spring Creek development. A number of small wells, producing a green-black oil of 47½° gravity from the First sand. Unimportant.

No. 18. *Grand Valley.*—Dates from 1885. Moderate wells. Third sand. Now pretty thoroughly developed. Gleaning.

No. 19. *Tidioute and Triumph.*—Includes New London and Colorado. An old and exhausted field. Gleaning.

No. 20. *Church Run and Octave.*—Including Titusville, Watson Flats, the Drake well, etc. Scene of the earliest developments. Production now small. Gleaning.

No. 21. *Enterprise.*—An old field with very little output. Gleaning.

No. 22. *Neilltown.*—A development of small extent and notable for the fact that the oil is of an amber color, although it apparently comes from the third or green oil sand. The only instance of the kind in the northern oil field. Gleaning.

No. 23. *Fagundus.*—A very productive field in 1870. Now reduced to the gleanings from a few wells.

No. 24. *Dennis Run.*—An old black oil district. Unimportant.

No. 25. *West Hickory, Fogle, etc.*—A cluster of pools, embracing the Neill, Stufflebeam, Fogle, McIntyre, White, McGrory, Greene, Dawson and other farms. Small wells, irregular sands and oils of varying gravities derived from first, second and third sand horizons. Gleaning.

No. 26. *Oil Creek, Reno, etc.*—Including all the old Oil Creek developments, the Reno belt, Shamburg, Pleasantville, etc., also covers the field of the Second-sand develop-

ments in 1888. Oil from the first, second, stray and third sands, amber, green and black. Gravity 43° to 51°. Gleaning.

No. 27. *Pithole.*—The location of the renowned Pithole City excitement in 1865. Exhausted and abandoned. Not a well has been producing in the district for several years.

No. 28. *Cashup.*—A rich pool in 1872. Now abandoned.

No. 29. *Sowers.*—Including Jamieson farm. A small well or two of second sand oil in 1865. Unimportant.

No. 30. *Tionesta.*—A few small wells in olden times but later tests show the field to be unimportant.

No. 31. *Walnut and Henry's Bends.*—Two old pools which have produced considerable oil. A few small wells are still at work. Unimportant.

No. 32. *McGrew.*—A small well in 1888 showing the presence of oil in that locality. Undeveloped.

No. 33. *Clapp-Fleming.*—A new pool of good wells developed in 1888 and still undefined.

No. 34. *Cooperstown.*—Old pool. Irregular sands. Unimportant.

No. 35. *Sugar Creek.*—Some heavy oil in former years. Unimportant.

No. 36. *Utica.*—A little heavy oil. Unimportant.

No. 37. *Franklin and vicinity.*—Lubricating oil of excellent quality. First sand.

No. 38. *Two Mile Run.*—Second sand oil. Unimportant.

No. 39. *Raymilton.*—Small but lasting wells. Gleaning.

No. 40. *Fosters, Cochran farm, Bully Hill, and Lower Two Mile.* Formerly very prolific fields, second and third sands. Gleaning.

No. 41. *Sage Run.*—Old. Gleaning.

No. 42. *Hoge farm.*—Old. Gleaning.

No. 43. *Norway.*—Old. Gleaning.

No. 44. *Tipperary.*—Discovered in 1886. Production now small.

No. 45. *Cranberry.*—Old. Gleaning.

No. 46. *Hall's Run.*—A moderate production and rather uncertain sand rock.

No. 47. *Tar Kill.*—Discovered September 16, 1885. Fine wells. Developed and declining.

No. 48. *Gas City.*—Old pool. Unimportant.

No. 49. *East Sandy.*—Some good wells.

No. 50. *Scrubgrass.*—Old. Abandoned.

No. 51. *Bullion.*—Once an important field. Gleaning.

No. 52. *Red Valley.*—A prolific pool in 1886. Gleaning.

No. 53. *Nickelville.*—Only a few good wells. Very treacherous.

No. 54. *Cogley Run.*—A prolific pool in 1885.—Gleaning.

No. 55. *Lucinda.*—Opened in March, 1889. Of no great importance.

No. 56. *Emlenton and Six Corners.*—Old fields which have yielded a great deal of oil and still furnish many small wells.

No. 57. *Rumbaugh.*—Old and never of any importance, as only a few wells were obtained.

No. 58. *Clarion.*—Developed early in 1888. Some very large wells but soon declined. Limited in extent and disappointing to those attempting to enlarge it. Oil from so-called fourth sand, the equivalent of the third of Oil Creek.

No. 59. *Reidsburg.*—Small wells of amber oil. Unimportant.

No. 60. *Clarion-Butler.*—Including all the old fields of these districts and Whiskey Run, Brady's Bend, Kalor, Somerville, also the more recent developments of Pontius, Hickey, Herman, etc. Considerable unproductive territory is included within the outlines but all of it properly belongs to this great oil field. Central parts pretty well developed.

No. 61. *Glade.*—A limited area, producing oil from the first sand, here called the "Hundred-foot."

No. 62. *Thorn Creek, etc.*—Including Thorn Creek extension, Baldridge, Reibold and Glade Run, not all directly connected but practically one field. Has furnished very large wells and is still one of the most important fields.

No. 63. *Saxonburg.*—Developed in 1887 and prolific. Probably not yet fully outlined.

No. 64. *Phillipsburg.*—A number of small wells. Not very important.

No. 65. *Legionville.*—First well early in 1889. Undefined.

No. 66. *Brush Creek.*—Opened in November, 1887. A new field of considerable importance.

No. 67. *Bakerstown.*—Apparently a field of promise but one which has so far been rather disappointing to its developers.

No. 68. *Shannopin.*—Opened in January 1886. A very prolific field, but now pretty well defined and on the wane.

No. 69. *Mt. Nebo.*—A field of promise in May, 1885, which has never realized the expectations of its prospectors.

No. 70. *Murdocksville.*—Opened in 1888. A good field and still extending.

No. 71. *Montour Run.*—A few small wells. Not considered very promising.

No. 72. *Crafton.*—1888. Developing but hardly meeting expectations.

No. 73. *Canonsburg.*—Developing. Some good wells. Oil sands irregular.

No. 74. *Taylorstown.*—August, 1886. Prolific. Probably not yet fully outlined.

No. 75. *Knox.*—Developing. Prolific wells.

No. 76. *Gordon.*—Opened in 1886. Declining.

No. 77. *Washington.*—Commenced with Gantz well, January 1, 1885. Reached its maximum in summer of 1886. Still affording some good wells, but on a decline.

No. 78. *Nineveh.*—Opened by Smith well No. 3, August 25, 1888. Not yet outlined, but oil rocks evidently unreliable.

Berea Grit.

Pocono, No. X.

A white to gray sandstone; generally a fine-grained rock; but coarse and sometimes pebbly where productive. Oil a beautiful light-amber color. Gravity 47° to 49°.

No. 79. *Slippery Rock.*—One of the early fields. Unimportant.

No. 80. *Smith's Ferry.*—Old but still occasionally furnishing a good well along its borders.

No. 81. *Turkeyfoot.*—Opened in October, 1888, and still developing.

No. 82. *Hookstown.*—Opened in May, 1889, and still developing.

Sub-Olean, Shenango Sandstone—"Big Injun."

Pocono, No. X.

A white sandstone of medium grain, with some small pebbles. Where the rock is very thick the top is generally a lime-sand, which changes gradually into a sandstone. But drillers usually call it all sand. Amber oil, gravity 48°.

No. 83. *Mount Morris.*—Opened in October, 1886. A promising field and still in process of extension.

No. 84. *Doll's Run.*—First well in May, 1889. Undeveloped.

Mahoniny Sandstone.

Pittsburgh Series, No. XIV.

A grayish-white sand, where productive, about thirty feet thick.

Oil reddish-amber, gravity 46°, heavy oil in Westmoreland county.

No. 85. *Pleasant Unity.*—Old. Abandoned.

No. 86. *Brownsville.*—Old. Never of any importance.

No. 87. *Whiteley Creek.*—Now of little importance.

No. 88. *Dunkard Creek.*—Now of little importance.

GAS POOLS.

Northern Division "Black Sands."—Devonian, No. VIII.

No. 1. *Mt. Jewett.*—Some gas, but no large development. Piped to Mt. Jewett.

No. 2. *Kane.*—Abundant supply. Used locally and piped to Bradford.

No. 3. *Wilcox.*—First well in 1865. Abundant supply. Piped to Bradford, Salamanca, Buffalo, etc.

No. 4. *Roy & Archer.*—Large gas in 1881. Used locally in making charcoal and acid from wood.

No. 5. *Johnsonburg.*—Abundant. Used locally and piped to Ridgway and St. Mary's.

No. 6. *Millstone.*—Large gas. Held in reserve.

White and Gray Sands.—Devonian. No. VIII.

No. 7. *Sheffield.*—Opened by Hague well in 1875. Pioneer well still flowing. Used locally. Piped to Sheffield, Warren, Jamestown, N. Y., Corry and Erie. A large and reliable field.

No. 8. *Clarendon.*—Used locally and piped to Clarendon.

No. 9. *West Hickory.*—Opened December, 1887. Piped to Tidioute, etc.

No. 10. *Speechley.*—Opened early in 1885. Used locally. ly. Piped to Franklin, Meadville, Mercer, Sharon, Oil City, Titusville, Pleasantville, Tionesta, etc.

No. 11. *Brookville.*—Small supply, partly from the Big Injun and partly from a lower sand. Piped to Brookville.

No. 12. *Canoe Creek.*—Abundant. Piped to Punxsutawney and other towns. Gas from an horizon certainly as low as the Speechley sand.

Venango-Butler Group.—Catskill, No. IX.

No. 13. *Newton well.*—Piped to Titusville in 1872; still supplying a few fires.

No. 14. *Marienville.*—Moderate flow; supplies Marienville.

No. 15. *Clarion.*—Not voluminous, but piped to Clarion.

No. 16. *Millville.*—Piped to New Bethlehem, Millville, etc.

No. 17. *Harrisille.*—Developed in 1885; intended for Youngsville, Ohio, but found insufficient and not piped there.

No. 18. *Centreville.*—Piped to New Castle in 1885. Now only sufficient for Centreville.

No. 19. *Kittanning.*—The main pool has supplied Kittanning for several years, but since Ford City was built with its immense plate glass works, and commenced to draw upon it, it has been found necessary to reinforce its supplies. Other wells have been obtained, as noted, on the east side of the river, but nothing which indicates a very extensive deposit has yet been discovered there.

No. 20. *Saxon Station.*—Considerable gas used locally.

No. 21. *Baden.*—Piped to towns along Ohio Valley.

No. 22. *Economy.*—Piped to towns along Ohio Valley.

No. 23. *Bakerstown.*—Some good wells.

No. 24. *Lardintown.*—Piped to Sharpsburg in 1876. Now unimportant.

No. 25. *Freeport.*—Formerly some gas. Now unimportant.

No. 26. *Tarentum.*—First well in 1878. A large field in 1885. Now only available for local use.

No. 27. *Leechburg.*—First well in July, 1871. Unimportant.

No. 28. *Apollo.*—Formerly some small wells. Unimportant.

No. 29. *Pine Run.*—Opened January, 1885. Piped to Appolo, Leechburg, Freeport, Natrona, etc., and being introduced into Saltsburg.

No. 30. *Homewood.*—Opened by Westinghouse Well No. 1, in 1884. Gas from Butler gas sand. Unimportant.

No. 31. *Murrysville.*—First well, Haymaker No. 1, in 1878. Piped to Pittsburgh in summer of 1884. Other lines rapidly laid to it. Thirteen wells flowing January 1, 1885. About 150 Jan. 1, 1889. Seems to be pretty thoroughly developed and probably has passed its greatest output.

No. 32. *Grapeville.*—A large field; not yet thoroughly drilled. Piped to Johnstown and towns by the way; to Connellsville, Scottdale, Uniontown, and other places in that direction, to Braddock, Pittsburgh and also used locally in the great glass works at Jeannette and other places near the belt.

No. 33. *Latrobe.*—Some moderate wells supplying Latrobe and also connected with the Johnstown line.

No. 34. *Beaver.*—A large field opened in 1885 already heavily drawn upon and weakening in pressure. Piped to Phillipsburg, Rochester, Beaver Falls, and Youngsville, Ohio. Also westerly and southerly to several of the Ohio river towns.

No. 35. *Hickory.*—A large field opening with the McGuigan well in 1882. Piped to Pittsburgh and towns along the line, and to Wheeling and other places southwest. Gas

from the "McGuigan sand," and in some wells from the Homeward sandstone.

No. 36. *Ridgeville.*—Piped to Pittsburgh, etc., and used locally.

No. 37. *Jefferson.*—Piped to Jones and Laughlins' American Iron and Steel Works, Pittsburgh.

No. 38. *Canonsburg.*—First well November, 1884. Piped to Pittsburgh and used locally.

No. 39. *Washington.*—Opened by Hess well, April, 1884. Piped to Washington, etc.

No. 40. *Manifold.*—Piped to Pittsburgh and used locally.

No. 41. *Belle Vernon.*—Opened in 1887. Piped to Belle Vernon, etc., and soon to be connected with Pittsburgh.

No. 42. *Brownsville.*—Some small wells, but not very reliable.

Sub-Olean. "Big Injun."—Pocono, No. X.

No. 43. *Fayette.*—Opened by Ryder well in 1887. One very powerful well and two smaller ones. Piped to Uniontown.

No. 44. *Mt. Morris.*—Strong gas, used locally and piped to Morgantown, West Virginia.

"Gas used locally," indicates that there is considerable consumption near the wells. Frequently a large quantity is used in drilling other wells to which it is sometimes piped for miles.

"Unimportant," indicates that the pools have weakened and are now only of local value.

Several spots on the map are noted, but not numbered. They generally indicate single gas wells.

In the city of Erie and along the lake shore many wells, probably two hundred, have been drilled and more or less gas obtained. Nearly all that country is a low pressure gas field, and while the wells are useless for pipe-line purposes, they are long-lived and of great value to land owners who, by putting down a well on their own premises, can almost always secure a reliable supply of fuel and light for many years.

Chapter IV.

The Corniferous Limestone, and the overlying Hamilton, Genesee, Portage and Chemung Groups, or Formations, with Plate No. 3, Showing the Slope of the Corniferous Limestone Upwards towards its Outcrop in New York, Canada West and Ohio.

Referring to the vertical section, Plate IV, it is seen that the several groups of rocks particularly mentioned in this report are as follows:

XVII. Greene county group.
XVI. Washington county group.
XV. Monongahela series.
XIV. Pittsburgh series.
XIII. Allegheny series.
XII. Pottsville conglomerate.
XI. Mauch Chunk.
X. Pocono.
IX. Catskill.
VIII. Portage, Chemung, Genesee and Hamilton, to base of the Corniferous limestone.

A vertical section of these rocks in their average development measures about 6,875 feet and every well-defined and persistent sandstone discovered in the series below the Pottsville conglomerate, has, in one locality or another in the state, produced either oil or gas in commercial quantities.

A brief stratigraphical review of the different groups enumerated in the above scale will now be given, from the bottom upward, in agreement with the natural sequence of deposition.

The Corniferous limestone outcrops at Black Rock, New York, forming a slight barrier and a small island in the outlet of Lake Erie. From this point it can be traced eastward as far as Cayuga lake, and westward through Canada

to the Enniskillen oil fields. Dipping at the rate of abont 25′ per mile from Black Rock, it is found in the gas wells at Fredonia at 315 feet below tide. Thence it plunges under the oil fields of Pennsylvania to rise again along the easterly slope of the Cincinnati arch in eastern Ohio.

In western Pennsylvania only three deep wells are known to have reached it—the Presque Isle well in the city of Erie, at 725′ below tide; the Wheatland well near West Middlesex, Mercer county, at 2,517 feet below tide, and the Conway well on the Allegheny river about nine miles below Franklin at 2,900 feet below tide; these levels show a dip of 38′ to the mile in a south by east direction from Erie and explain why all the other deep wells of the region have failed to find the limestone, for even Westinghouse's 4,618′ well at Pittsburgh, which stopped at 3,733 feet below tide had not been sunk to a sufficient depth. Of course it cannot be said positively that the Corniferons limestone extends in a recognizable form under the whole basin, bnt having been found in good thickness and well attested by the overlying Marcellus shale to a distance of sixty miles south of the lake, there would seem to be little doubt of its farther extension in that direction.

In Ohio it is pretty definitely located in many wells, among which the following, selected from those referred to in Geological report of Ohio, Vol. VI, may be noted.

Page.	*Locality.*	*Ocean level.*
302	Plymouth, Richland county, ...	+290
303	Crestline, Crawford county, ...	+387
317	Newark, Licking county, ...	—615
317 & 367	Mt. Vernon, Knox county, (unreliable)	—471?
320	Massilon, Stark county, ...	—1,581
319	Akron, Summit county, ...	—925
346	Milan, Erie county, ...	+415?
348	Wellington, Lorain county, ...	—174
352	Cleveland, Cuyahoga county, ...	—570
362	Wooster, Wayne county, ...	—890?
363	Bucyrus, Crawford county, ...	+230
365	Shelby, Richland county, ...	+222
365	Mansfield, Richland county, ...	—21
305	Ironton, Lawrence county, ...	—1295
282	Columbus, Franklin county, ...	+630±
320	Canal Dover, Tuscarawas county,	—1,816 bottom of well.
321	Youngstown, Trumbull county,	—1,630 bottom of well.
322	East Liverpool, Columbiana county,	—2,260 bottom of well.

These data are not sufficient for a very satisfactory study of the elevations and dips of the Corniferous limestone, (for the points are too far apart and there may be important local variations between them) but we have used them tentatively, on the small sketch map, plate No. 3, on which its upper surface is shown by contour lines drawn, vertically 300′ apart. This sketch, imperfect as it is, brings out the trend and slope of the rock in an interesting manner; and, studied in connection with the fact that the mass of overlying shales between the limestone and the carboniferous rocks is much thinner along the westerly and northerly rim than at points east and south of it, suggests the probability that the limestone was deposited on a floor sloping somewhat as we find it at present.

Superimposed upon this limestone lies the Erie division of the New York Reports, which, in ascending order, is composed of the Marcellus slates or shales, characteristically black and pyritous, the Hamilton group of gray shales and limestones, the Genesee slates, black and similar in appearance to the Marcellus, and the Portage and Chemung groups. These deposits bring us up to the base of the Venango-Butler oil group.

The Marcellus, Hamilton and Genesee divisions seem to be fairly represented in the Presque Isle well, but in the other two a lack of proper attention to the sand-pumpings causes some obscurity in these horizons. The Marcellus slates, however, are characteristically developed in all the wells. The Portage and Chemung are lithologically indivisible under the oil regions of Pennsylvania, being in most places a homogeneous mass of slates and slaty shales devoid of any distinguishing peculiarities either in color or composition that might suggest a line of division between them.

In Conway well the vertical distance from the base of the Venango group to the top of the Corniferous limestone is about 3,275′, in Wheatland well 2,635. At Erie the lime was struck at 1,325′, the drill having commenced in the lower part of the Portage-Chemung division. We have no means for determining, absolutely, how much of the Che-

mung has here been removed by erosion. Probably about 1,175′ would be a fair estimate, which gives 2,500′ as the thickness of the whole mass at Erie. These figures show a great thickening of the formations under consideration beneath the southern part of Venango county, and the well drillings indicate that the increment is in the Portage-Chemung group, and not in the underlying Hamilton, etc.

Bearing in mind the fact that the Chemung group forms the floor upon which the Venango-Butler oil sands rest, and that all the oil and gas producing rocks of Allegany, New York, McKean, Potter and Elk counties, Pennsylvania, and the deep sands of Warren, Forest and east Venango lie embedded in its upper part, the deepest or Elk county oil sand not being more than 1,700′ from the top of the formation, one cannot fail to realize how important this top plane of division becomes in an intelligent discussion of the various oil horizons above or below it, and how necessary it is to find an answer to the question, "How can this old Chemung floor be located in our oil well sections?"

In the first place let us see how the lithologic composition of the upper portion of the Portage-Chemung compares with that of the Venango group.

In report III, page 237, the following language was used: "The lowest member of the Venango oil group, whether it be called third sand, or fourth, or fifth, appears to mark the commencement of a new era in the history of that part of the Appalachian basin in which it is found. Anterior to its formation, the conditions of the ocean bed geographically coincident with the trend of the group, seems to have remained comparatively constant and uniform for ages. Drillings from rocks lying from one to two thousand feet below it, disclose only such finely levigated sediments as would naturally be deposited in comparatively still, deep water, beyond the perturbing influences of surface or shore. * * * * So long as these broad oceanic conditions which had obtained for ages in this latitude continued, so long the same kind of sediments resulted. But at this point of time (the commencement of the oil group) a new class of sediments came in, coarse sand and gravel are now

laid down over large areas, where previously only mud and arenaceous shales had been deposited. A radical change evidently must here have taken place both in physical conditions and geographical outlines of the great basin receiving the sediments, and the adjacent lands supplying the materials. * * * * The base of the oil group appears to furnish a well developed plane of demarkation between the mud rocks of an age of uniform conditions and the sandstones and shales of a period of mutability and unrest. Below this horizon everything appears to be of a deep sea, still water type ; above it, strong transporting currents, shifting in position and level, and locally intermittent or variable in action, have inscribed the evidence of their presence, and left us the witnesses of their achievements, in irregularly alternating strata of conglomerate, sandstone and shale, all the way up to and through the coal measures."

This was written in 1878 with particular reference to facts observed along the range of the Venango oil belt. Since that time, and especially within the last three or four years, a great deal of deep drilling has been done in evey part of oil regions, and copious collections of facts from an enlarged scope of territory now furnish reliable data for wider generalizations.

The statement that the productive sands of the Venango-Butler oil group repose upon thick beds of finely levigated sediments in which no persistent sandstones are embedded, has now been verified, by the drill, from Warren county to Greene ; but it is plainly evident that the gentle and uniform methods of deposition which prevailed during the Portage-Chemung period in that part of the basin which is now overlaid by the Venango-Butler oil sands, were confined within certain fixed limits, for in Forest, Warren and McKean the alternating beds of sandy and slaty deposits in the Chemung horizon betoken the work of much more active agencies.

In Warren and Forest, the upper part of the Portage-Chemung encloses several well-defined and massive layers of white or gray oil-bearing sandstones ; the first lying about 300′ from its top, the last about 1,200′. These are

known in descending order as the oil sands of Warren, Clarendon, Cherry Grove, and Cooper; and they lie embedded in typical Chemung slates which also extend below the Cooper sand as far as the drill has pierced. Some of the productive pools of this group lie not more than ten miles east of productive pools in the Venango group; but the sands of the former thin out and disappear in this interval, so that hardly a trace of them can be found in the deep wells sunk through the latter.

To the southwest, however, one of these deep sands can be traced across Forest and Venango for about thirty miles, and in eastern Venango—under the name of "Speechley sand"—is largely productive of gas, but, so far, barren of oil. This gas rock underlies the middle ground between the Venango and the Clarion oil belts, where the Venango group is imperfectly developed.

The McKean Group.—Stretching out towards the northeast, the Warren sands extend into the Bradford district and no doubt some of them could be identified with the upper sands of the Bradford or McKean group, if drillers would take the trouble to keep a few reliable records in this region. But they will not do this and we must be content with the above qualified statement as it is impossible under the present circumstances to systematically trace any particular stratum from one district to the other.

The Oil Creek idea of three sands was transplanted in the Bradford field by the early drillers, the formula of about 100 feet from sand to sand being altered to 300 feet. It is true that in some parts of the field there are sandy measures lying about 300′ and 600′ above the oil sand, but they are variable beds of flaggy sandstones and sandy shale of considerable thickness (sometimes most sandy at top, sometimes at bottom) composed of alternating layers of gray and brown sand, no one member of which can be followed as a persistent, well-defined, massive sandstone for any great distance in the same horizon. After the field was fairly opened and the depth to the so-called third sand had been well ascertained, no attention was paid to the first and second sands. If one asked for a well record he got simply

the depth to the oil sand. If he inquired about the upper rocks he was told that they were "regular." "What do you mean by regular?" "Why a first sand, then about 300 feet of slate, then a second sand, then about 300 feet of slate—it is always about 600 feet from the first sand to the oil rock." This idea of "regularity" has cost oil operators tens of thousands of dollars, while prospecting on the outskirts of productive fields. The so-called first and second sands are not persistent and well-defined strata that can be unmistakably recognized by the driller on sight of the sand pumpings. Yet in a number of wells which can be pointed out, he has located his first sand without a suspicion of the possibility of mistake—drilled down the "regular" 600′ and abandoned his hole when the bottom was still several hundred feet above the rock he was seeking. But this is a digression—except so far as it shows how difficult it is to obtain the facts required for a proper identification of the rocks of one district with those of another.

In the hillsides of Tuna Valley, near Bradford, the characteristic red rocks of the Venango group, accompanied by some sandstones, are seen outcropping above bluish-gray, sandy, slaty, shales—the latter being in many places crowded with fossils of undisputed Chemung age. From these outcrops and the records of summit wells, the line of demarkation between the two groups can be accurately located. Measuring down from the Chemung floor upon which the Venango group rests, the top of the Bradford oil sand is found at a depth of a little less than 1,200 feet. Hitherto this vertical distance has usually been called 1,000 feet more or less, a measurement obtained in 1875, by calculations based on the Olean Conglomerate, on the presumption that the immediately underlying measures were of the same thickness at Bradford, as at Tidioute—the two points used in making the estimate. It is now found that the Chemung lies 765′ below the Olean Conglomerate at Tidioute and only 570′ below it at Bradford (see report of 1886, plate 1), hence this addition of 200′ to the old estimate. This interval of 1,300′ (100′ being added as the maximum thickness of the Bradford sand), is occupied by alternating beds of slate and

sandstones similar to those in the same horizon under Warren and Forest, except that it contains more of the brown element which at the bottom entirely supersedes the gray and gives to the Bradford oil sand its peculiar chocolate-brown and brown-black color.

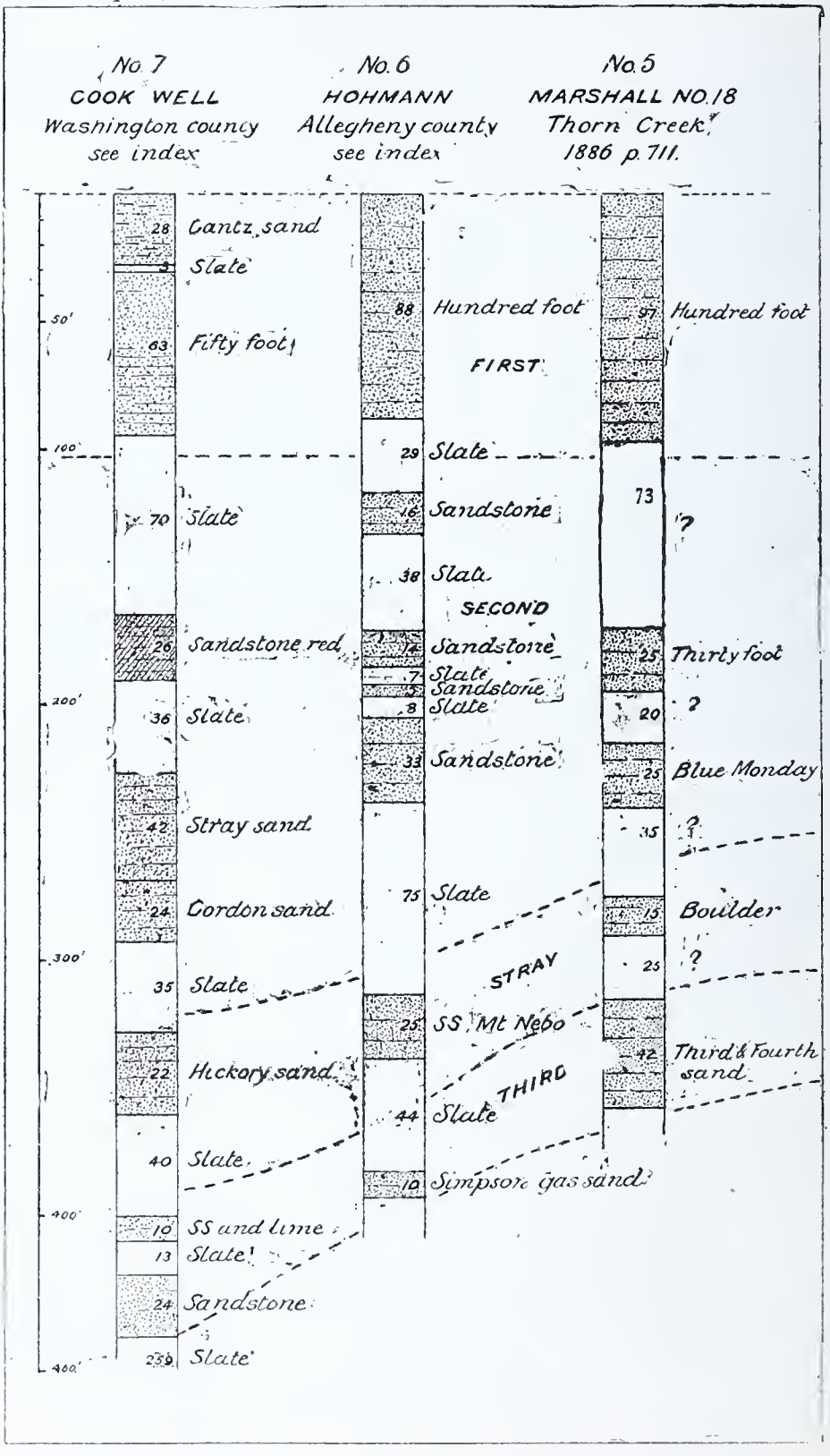
Elk Group.—Along the southeasterly edge of the Bradford field, and also of Warren and Forest, two or three other brown sands are found beneath the horizon of the Bradford sand, the lowest one lying about 1,700′ below the top of the Chemung formation. These sands, which I have called the Elk group, are found at Startwell, Smethport, Wilcox, Kane, and in Elk county. They appear to be meagerly developed beneath the Bradford and Warren–Forest groups to the northwest, and *per contra*, the sands of the last named groups are poorly developed or entirely wanting along the range of the Elk group. It is to be remembered also that the Bradford oil sand is limited approximately in its western extension to a northeast-southwest line projected through the Cooper field of Warren county, where a brown sand, somewhat similar to the Bradford oil rock, and which is sometimes productive immediately overlies the white or gray Cooper sand.

Reviewing what has been said above, it is seen that all along the Venango-Butler oil belt from Tidioute southwestward, the Portage–Chemung is simply a homogeneous mass of slates or slaty shales, with no sandy layers worthy of note; that under the Warren and Forest district it contains in its upper 1,200 feet several beds of coarse, white or gray oil sands, the first one lying about 300′ below the top of the mass—this 300′, the intervals between sandstones, and the measures below the Cooper sand, as far as the drill has gone being occupied by grayish slates or shales, with some bands of red, similar to those underlying the Venango belt; that under the Bradford district to a depth of about 1,300′ (and Allegany, N. Y., may be included here), similar conditions to those of Warren and Forest exist, except that the most productive sands of Bradford are brownish-black instead of white or gray; that in Potter, southeastern McKean and Elk, other brown sands are found to the depth of about

400′ below the horizon of the Bradford sand; and that in these fields, as in the pools along the Venango belt, the productive portion of one range never, as a general rule, overlaps the productive portion of another.

The deposition of sands and slates at the northeast and slates only at the southwest seems to indicate that the unassorted materials came into the basin from a northeasterly direction and became subjected to the control of certain distributing agencies which prevented the deep sands of Potter and Elk from invading the Bradford and Warren–Forest fields, and the sands of the latter from invading the Venango–Butler fields. But it is to be noted that the uppermost 300′ at least of these Chemung deposits are very similar in composition and color in all the oil fields and wherever they have been pierced by the drill in western Pennsylvania. Evidently then, these wide-spread beds of bluish-gray slates which can be recognized in almost any locality where found, may render some assistance in answering the question previously asked; "How can this old Chemung floor be located in our oil well sections?"

Carll's Report, 1890. *Page plate 3 a.*



Chapter V.

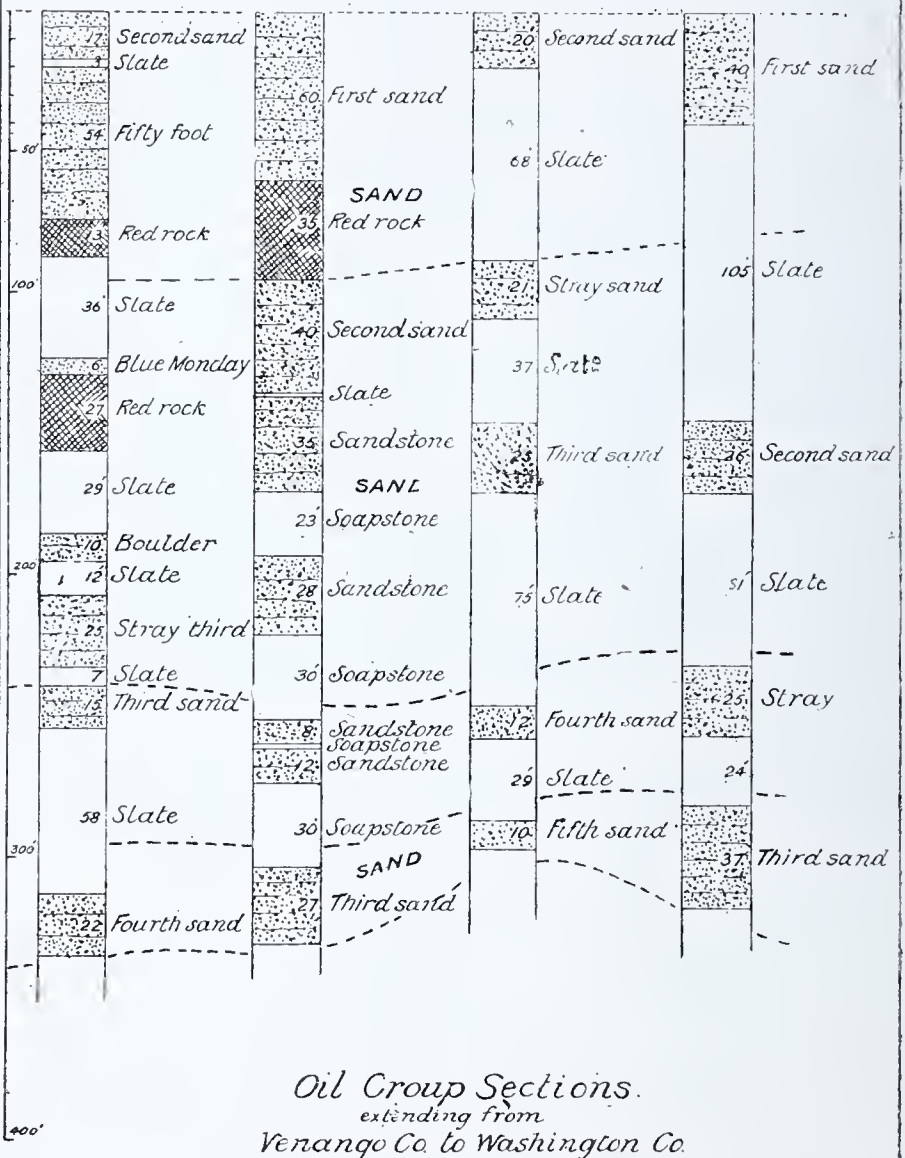
The Venango-Butler Oil Group, from Warren County to Greene County; with Page Plate No. 3, Showing its Increase of Thickness Southward from Warren to Washington, and Page Plate No. 4, Showing its more Rapid Increase Eastward from Allegheny County into Westmoreland County.

In view of the facts that the conditions of sedimentation during the close of the Chemung period were stable and uniform over that part of the bottom of the old basin now embraced in western Pennsylvania, and that subsequently some remarkable crust-movement must have occurred which interrupted the previously existing relations between shorelines and depositing currents, making it possible for coarse, pebbly sands to be thrown down along the present range of the Venango-Butler oil belt upon this floor of finely levigated materials which had been accumulating for ages in a quiet sea, there ought to be no hesitation in locating the top of the Chemung at the base of the first sand sheet reposing upon these still water deposits.

But another means of recognizing the horizon presents itself. A study of well records from the country east of the productive portion of the oil belt makes it plain that the same causes which opened the way for coarse sands to invade this muddy zone of the Chemung sea, also let in contemporaneously, an influx of red sediments from the east; hence, in many localities where the sand is absent, red rock stands in its place to mark the plane upon which the new deposits commenced to accumulate.

But it must not be inconsiderately inferred from this that the exact plane of division is always conspicuously marked. Although the two elements introduced into the basin at

Carll's Report 1890. Page Plate No 3 b.



Oil Group Sections.

extending from

Venango Co. to Washington Co.

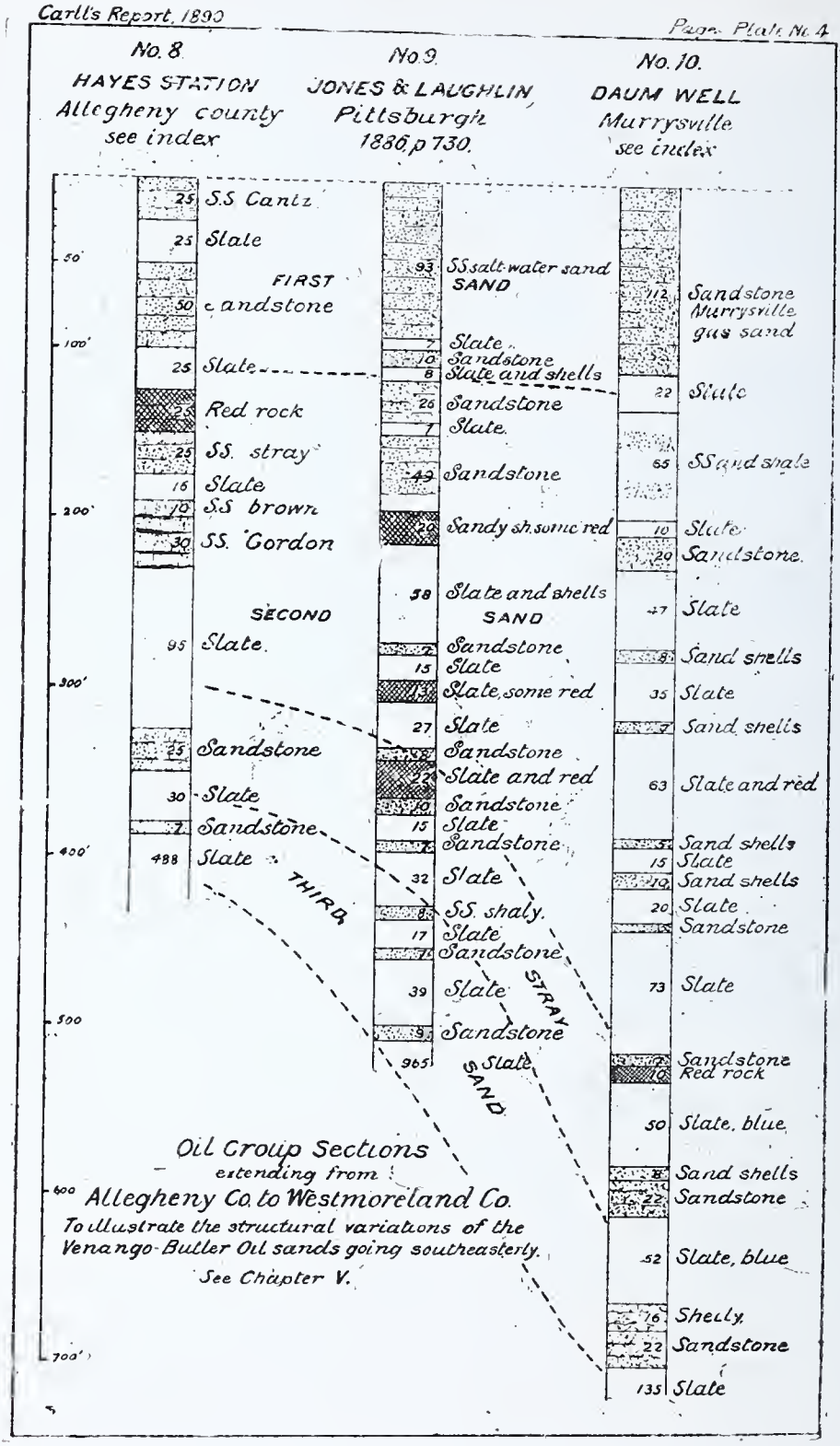
To illustrate the structural variations of the Venango-Butler Oil sands going southwesterly

See Chapter V

this time were coarse sands and red clays, there can be no doubt that in some localities a great deal of reworked Chemung material was coming in also. In deep water the incoming eastern reds were dropped upon an unabraded and undisturbed Chemung floor. Here the line between gray and red is sharp and unmistakable. But in consequence of the altered relations of land and water, some parts of the old uneven sea bottom must have been exposed to the action of erosive currents and others, presumably, to atmospheric erosion, thus an intermixture and blending of Chemung sediments with the newer deposits took place, and where this happened the division plane is sometimes quite obscure.

The Venango-Butler oil sands, by this line of reasoning, are placed among the rocks of Catskill age. Early in the progress of the survey in the oil regions exceptions were taken to the then universally received opinion that they were undoubtedly Chemung. On stratigraphical grounds, the claim was advanced that they were younger rocks, to say the least, probably a band of transition strata laid down while Chemung was merging into Catskill. At that time very little exploration with the drill had been made of the country to the east and southeast of the oil belt, and no direct connection with the Catskill group of the east could be satisfactorily shown. Not long afterwards, however, Mr. Ashburner, while making his geological surveys in McKean, Elk and Cameron counties, succeeded in securing the connecting links between east and west. After carefully collating his data and preparing a plate of sections to show the stratigraphical relations of the several groups of rocks in his district, he came to the conclusion that the Venango oil sands are neither Chemung nor transition, but Catskill. This conclusion with corroborating proofs of its correctness, was published in Report R, in 1880, Mr. Ashburner being the first geologist to make an unqualified announcement of this important fact.

It is not at all surprising that geologists thirty years ago with little reliable stratigraphical evidence to guide them, assigned the Oil Creek sands to the Chemung group, for it


Carll's Report, 1890
Page Plate No. 4
No. 8.
HAYES STATION
Allegheny county
see index
No. 9.
JONES & LAUGHLIN
Pittsburgh
1886, p 730.
No. 10.
DAUM WELL
Murrysville
see index
25 S.S Cantz
25 Slate
50'
FIRST
50 Sandstone
100'
25 Slate
25 Red rock
25 SS. stray
16 Slate
200'
10 SS brown
30 SS. Gordon
SECOND
95 Slate.
25 Sandstone
30 Slate
7 Sandstone
400'
488 Slate
THIRD
93 SS salt-water sand
SAND
7 Slate
10 Sandstone
8 Slate and shells
26 Sandstone
1 Slate.
49 Sandstone
20 Sandy sh. some red
38 Slate and shells
SAND
2 Sandstone
15 Slate
5 Slate, some red
27 Slate
Sandstone
Slate and red
Sandstone
15 Slate
Sandstone
32 Slate
8 SS. shaly.
17 Slate
Sandstone
39 Slate
STRAY
9 Sandstone
500
965 Slate
SAND
112 Sandstone
Murrysville
gas sand
22 Slate
65 SS and shale
10 Slate
20 Sandstone.
47 Slate
8 Sand shells
35 Slate
7 Sand shells
63 Slate and red
3 Sand shells
15 Slate
10 Sand shells
20 Slate
Sandstone
73 Slate
2 Sandstone
10 Red rock
50 Slate, blue
Sand shells
22 Sandstone
52 Slate, blue
76 Shelly
22 Sandstone
135 Slate
600
700'
Oil Group Sections
extending from
Allegheny Co. to Westmoreland Co.
To illustrate the structural variations of the
Venango-Butler Oil sands going southeasterly.
See Chapter V.

must be admitted that along the axis of the oil belt and on its northwestern flank, their lithological characteristics have a Chemung aspect and the scanty palæontological evidences obtainable are suggestive of a close alliance with the fauna and flora of Chemung age. But now, having the means of tracing the rocks stratigraphically towards the east, we see these Chemung characteristics fading out in that direction and the sand rocks of the series invariably interstratifying with and becoming incorporated in the distinctive red beds of the Catskill age.

The Catskill deposits along and west of the Venango oil belt are evidently composed of a preponderance of reworked Chemung sediments but little removed from their original beds, and this probably accounts for the presence of Chemung fossils in them. Here there was a continuance of Chemung conditions into Catskill time, and Chemung life-forms were not destroyed as they were in the heavy red beds of the east, for the character of the sediments in which they had previously flourished was but little changed.

The stratigraphy of the Venango-Butler oil group has been quite fully explained in previous reports. Several page plates of sections were given in report I with special reference to the Venango district. Others appeared in I³ illustrative of the changes in the Clarion-Butler district, and it was there shown that an area of irregular sand deposits twelve to fifteen miles wide intervenes between the two districts and furnishes only occasional pools of oil.

Developments now extent southerly into Allegheny, Beaver, Washington and Greene, and overlap into West Virginia, but up to the present time no oil has been obtained from any of the sandrocks of this group south of Nineveh in Greene county, although gas has been found in one of them fifteen miles south of the state line. A great deal of drilling has also been done towards the east in Jefferson, Armstrong, Indiana, Westmoreland and Fayette. Thus the main features of the group begin to be pretty clearly outlined in all the southwestern part of the state, and we are now prepared to study the new fields with the old.

Along the axis of the Venango belt the sand group ranges

in thickness from 300 feet at Tidioute to 330 feet at Bullion. Toward the northwest the second sand thins out and disappears, and so do the enclosed red rocks. Toward the southeast and east the second sand splits into two or more members, the third in most localities thins, deteriorates in composition and becomes unproductive; red rocks interstratify with the sands beds, the group decreases in thickness or barely maintains its bulk, and finally, when traced still farther east, loses its sandy members and merges into the red shaly beds of the Catskill formation, which in this locality seem to thicken very slowly towards the east, being at Wilcox about 360′, Johnsonburg 460′, Du Bois 420′ and Clearfield 520′.

The Clarion-Butler sands measure 350′ at Edenburg, 330′ at Petrolia, and 360′ at Thorn Creek. On the western flank of the belt, no second sand and no red rocks are found. On the east the sands separate into many beds, red rocks increase in number, the group thickens and finally amalgamates with the red rocks of No. IX.

From Thorn Creek the group is plainly traceable as far south as Waynesburg, where it has a thickness of over 400′ and a considerable admixture of red, an intimation, it would seem, that the sands are not likely to extend much farther in that direction without being lost in the red clays which universally flank the southeasterly edge of the group and destroy its productiveness. These reds are known to be present at Mount Morris, Greene county, and at Morgantown and Farmington, West Virginia.

From Thorn Creek to Waynesburg the sands are deposited very irregularly, as if on an uneven bottom, or under the control of vacillating currents. No long and continuous belts like those of the upper country are found, and although the rocks are in some localities remarkably prolific they lie in comparatively small patches, with wide unproductive or exclusively gas-producing areas intervening. Towards the west the same features are observed as in the northern groups:—a tendency of the middle sand to thin out and disappear, and a paucity of red rocks. But towards the east the lower sands split up into many members, the

slaty intervals increase in thickness and take in considerable red, and the group as a whole, instead of shrinking in this direction as it does in some localities at the north, expands largely, measuring at Pittsburgh 500 and at Murrysville 700′ or more. Still the lowest sand always lies on good Chemung slates, as has been proven by many deep wells.

Deep wells in the Dunkard region of Greene Co., at Layton Station, Fayette Co., and at Waltz Mill, Latrobe, Blairsville, and Saltsburg, Westmoreland Co., show about 700′ of Catskill rocks, with a large increase of red; at Black Lick and Canoe Creek, Indiana Co., not so great a thickness, but nearly all red shale. At Johnstown, Cambria Co., if the well record given is reliable, the Catskill appears to have thickened materially.

The only reasonable inference to be drawn from the facts stated is that these southeasterly wells mark a limit in that direction, beyond which the Butler oil sands are not likely to be profitably productive of either oil or gas.

Another remarkable peculiarity of the southern oil field may be referred to. If a line be drawn from Brady's Bend to Pittsburgh and thence to Waynesburg, it passes to the east of all the oil pools yet discovered in the Butler sands in this section of the State. The extraordinary thickness of the group under a wide sweep of country east of the line indicated has just been mentioned. Why the large number of holes sunk to test it for oil has resulted in developing only two or three very small producers, who can explain? In the other districts oil and gas are intimate associates, and a gas well almost always indicates the proximity of oil. This region, however, is at the present time practically a gas field only, and it begins to look as if the expectations of those who have been cherishing the belief that where such an enormous volume of gas exists there must necessarily be a corresponding volume of oil, are not likely to be realized. But the field is large, and it is to be hoped that more thorough exploitation may yet disclose some oil pools within it.

Comparing the northern oil group in Venango and Clarion with the southern in Butler, Allegheny, Washington, etc.

it is seen that the latter contains in the aggregate the greatest thickness of sand beds and covers much the largest area. In the former, the aggregated thicknesses of all the sands in the group seldom exceed 120′, the average being considerable less ; in the latter, the First sand alone sometimes measures 120′; and in many places the total of all the sandy layers would make a solid bed 50′ thicker than the entire bulk of the Venango group north. Hence the Lower oil field must have been more favorably located than the Upper, relatively to the sources of supply and the distributing currents of the period in which the sands were deposited. It is observable that similar conditions prevailed throughout the succeeding period, as will be shown further on.

For the purpose of showing the continuity of the oil group, its structural variations in different localities, and the divers names which have been applied to its sub-divisions, seven sections are given on page plate No. 3, commencing in Venango county, and ending in Washington.

No. 1, is a fair type of the original Oil Creek wells where the drill commenced *below* the Berea grit and the oil sands were first discovered and named in regular order. There is no obscurity in this stratification ; the sands are massive and well defined ; slaty shales separate them one from the other ; about 200′ of similar shales overlie the First sand; and the Third always floors upon a thick mass of similar sediments, as shown by hundreds of wells that have been drilled deeply into them.

No. 2, represents the structure near Pithole City, where the wells commence *above* the Berea grit, the Second sand is found in two members, and the Third is poorly developed. Here the Berea grit was called First sand, and consequently all the sands of the oil group are misnamed. A similar misapplication of terms runs through the other sections.

The popular idea that the so-called Fourth and Fifth sands are lower strata than the Third sand of Oil Creek is an erroneous one. The thick and widespread bed of homogeneous shales beneath the oil group, proves that these deposits were made in quiet waters. During this period no cur-

rents capable of transporting sand, swept over this part of the ancient basin, and under the circumstances the deposition of gravel beds here was a physical impossibility. Some important change in the relations between the supply-sources and transporting currents was required, before these mud beds could be covered by sand. When this change came, the basal sand of the oil group began to be deposited and in due time the whole oil series was completed. The Third sand of Oil Creek lies at the base of the group, and the bottom sand in Butler, Allegheny and Westmoreland—by whatever names it may be called—is evidently a cotemporaneous deposit. The group varies in thickness, and its central members show considerable irregularity and inconstancy, but its top and bottom planes are always remarkably well defined.

No. 3, is a section near Parkers in Armstrong county. It shows a great increase of sand, with red rock in the upper horizons, but the Stray and Third maintain their normal relations to each other.

No. 4 is at Petrolia, Butler county. Here the First sand—taking in a little slate—had two names applied to it—Second sand and Fifty-foot rock. The location of the section is to the southeast of the axis of the belt; consequently considerable red rock is seen and an increased thickness of shale lies between the Stray and Third sands—but the latter are unmistakably identifiable in the so-called Third and Fourth sands of the section.

No. 5, at Thorn Creek, Butler county, is almost an exact counterpart of No. 2. The first sand ("Hundred foot") and third (here called "Third and Fourth") are much thicker than at Pithole; and the lower second ("Blue Monday") lies nearer to the Stray ("Boulder"); but the number of sands in the group is the same and there can be no doubt as to the true equivalence of anyone of them.

No. 6, in Ohio township, Allegheny county, shows the Second sand horizon widening, the Stray largely developed, and the Third much reduced in volume. The section is probably west of the axis of the group; but it is to be re-

marked that the Third sand is nowhere in this southern country so massively developed as it is farther north.

No. 7, Canonsburg—a good typical section of the oil group in Washington county. Of course there are many local variations in details of composition, but the leading features here seen hold good throughout the southern field. The Gantz sand and Fifty-foot evidently belong to the First sand horizon; the Gordon and its stray to the second. Hickory gas sand is merely another name for the Oil Creek Stray, the Butler Third and Boulder. The regular Third or bottom sand is fine-grained and compact in this region, and as far as I am informed, has never been profitably productive of either oil or gas. In fact most of the wells have not drilled into it, having stopped where oil or gas was found in the upper sands, or at the bottom of the Hickory sand, which a majority of drillers (making no allowance for the expansion of the oil group) consider a lower sand than the Third of Oil Creek.

On page-plate No. 4, three sections are given to show how greatly the oil group *thickens towards the east* in the latitude of Pittsburgh. No. 8 is at Hay's Station, Allegheny Co., about 9 miles west of Pittsburgh; No. 9 in Pittsburgh, southside; and No. 10 in the Murrysville gas field, Westmoreland Co., 18 miles east of Pittsburgh. As the central section lies two or three miles north of a right line between Nos. 8 and 10, there is necessarily more contrast between the easterly and westerly slopes than would appear if three sections in a line were compared. It is plainly seen however, that the greatest vertical expansion of the group occurs in the horizon belonging to the Second sand—the stratum, it will be remembered, which shrinks and disappears in a mass of sandy shales along the western edge of the oil belt. The Second sand period of deposition was evidently one of oscillating currents, for the sand beds are laid down with great irregularity and inter-stratified in some localities with lead-colored shale, in others with black, greenish, brownish or red.

Taking three sections for comparison, Nos. 1, 7 and 10, we find the approximate horizons assigned to the several

originally named sandstones expanding southward and eastward as follows:

Oil Creek, Canonsburg, Murrysville.

Horizon of First sand, ...	80	110	120
" " Second "	140	205	395
" " Stray "	50	60	100
" " Third "	50	60	90

The reasons for locating the dividing lines as seen on the plate are these: the First sand has certain characteristics of texture, grain and color which distinguish it from the Second or any of the subdivisions of the Second, and besides, it has been traced stratigraphically throughout the whole distance covered by the sections; therefore there can be little question about the limits of this horizon. The Second sand is conceded to be a variable deposit, but it has its own individual peculiarities which, in connection with its associations render the identification of its horizon an easy matter. Moreover, its upper limit is fixed by the First sand and its lower by the Stray, or black oil sand, one of the most easily recognized members of the group.

In most cases the Stray and Third may be traced stratigraphically; but one need not rely on that alone. Each rock has distinctive peculiarities of its own which assist in making identifications. The Stray is known as the *black oil sand*, and always produces a darker oil than the Third, or green oil sand, even in the southern country where both oils are much lighter than at the north. There is also a marked contrast in the color and quality of the sand beds; the Stray being notably a yellowish sand of well-rounded grains or pebbles, while the Third is white, with more flattish pebbles, or, if flaggy and unproductive, it is bluish-gray and muddy. The country covered by Plate No. 3, has been so thoroughly developed, and there are so many guides to assist in making identifications, that the division lines between the several sand horizons can be drawn with great assurance.

The identifications on Plate 4, have been made after careful study of very complete sets of sandpumpings from Nos. 9 and 10. All the specimens from the interval assigned

to the second sand have the distinctive peculiarities which belong to that horizon and to no other; and what is somewhat remarkable, although the Stray and Third were laid down in several thin beds composed principally of fine materials (as might be expected in a locality where alternating thin layers of sand and shale were deposited) they plainly announce their identities by the color and character of the sand pumpings which they have furnished. The specimens show unmistakably to what horizon of the group each sand belongs.

It will be noticed that all the wells referred to on this plate were drilled deeper than the Third sand in a fruitless search for still deeper oil rocks.

Chapter VI.

The Crawford Shales, including the Bedford Red-beds, Butler gas sand and Berea grit; with plate No. 5, showing the underground limits of the Red-beds.

The Crawford Shales, the next group in ascending order, are generally classed among the Vespertine rocks (*Pocono, No. X.*) They fill the interval between the First oil sand and the Sub-Olean (Shenango sandstone) and enclose the Pithole grit as a middle member. At the northern end of the Venango belt they are quite homogeneous in composition, and uniform in color, the Pithole grit being here barely distinguishable from the rest of the mass by a little larger deposition of sandy materials in its proper horizon. Farther south and in Butler county, the make-up of the group undergoes several important modifications. A few descriptive sections will be given to show its variations in different localities.

(1) At Tidioute, it is a mass of bluish-gray sandy shale from top to bottom, the Pithole grit being simply a sandy horizon and not a massive sandstone; thickness, 410′.* (2) At Franklin and Bullion, a bed of red shale a hundred feet or more in thickness, rests immediately upon the First sand, followed by about the same thickness of bluish shale. On this shale rests the Pithole grit, here a well-defined stratum which has been identified with the Berea grit of Ohio; carrying above it other beds of bluish-gray sandy shale; thickness, 385′. (3) In Brady township, Butler county, a similar structure to the last exists, except that the red shale is thinner, and lies about midway between the two sandstones; thickness, 400′. (4) At Petrolia no trace

* See Chapter V. Report 1886, which should be read in connection with this to explain the qualifications with which these measurements are given.

of the red shale appears, and the Berea grit can only be recognized by the presence of a few sands-hells in its accustomed horizon; thickness, 344′. (5) At Thorn Creek the section is further complicated by the lack of any distinctive sand beds in the horizon of the Berea grit, the absence of red shale, and the appearance of a massive sandstone (the Butler gas sand) lying about 80′ to 90′ above the First oil sand (here called the Hundred-foot rock) and about in the plane where the red rock should be due; thickness, 345′. (6) In Franklin, Ohio, McCandless and Ross townships, Allegheny county, no red rock is reported, and the interval is largely filled with sand beds, the Butler gas sand being sometimes over 100′ in thickness, and the Berea grit horizon containing two or three sands in some places, and in others being a solid mass from 80′ to 125′ thick; thickness, 490′. (7) At the mouth of Big Sewickley Creek, between Beaver and Allegheny counties, the 65′ interval between the First oil sand and the Butler gas sand is largely composed of red slate; the upper measures are sandy, and the Berea grit is here also fairly represented; thickness, 500′. (8) At Washington the interval again becomes shaly, no red rocks are seen; the Butler gas sand, reduced in thickness, appears in proper place, but the Berea grit cannot be satisfactorily located; thickness, 470′. (9) At Waynesburg, Greene county, both the Butler gas sand and the Berea grit seem to be represented in the first well drilled there. No red rocks; thickness, 415′. (10) At Pittsburgh, Butler gas sand well defined, Berea grit horizon indistinct in some wells, in others apparently well marked; no red rock; thickness, 406′. (11) At Murrysville, Butler gas sand fully developed; Berea grit wanting; no red rocks; thickness, 337′. (12) At Edenburg, Clarion county, the interval is, in the driller's language, "slate and shells;" no Butler gas sand; no Berea grit; no red rocks; thickness, 283′. (13) At Marienville, Forest county, same as at Edenburg, except that some red shales appear in the lower part; thickness, about 302′. It will be seen further on that variations in the thicknesses above given are partly accounted for by the changes in the overlying Sub-Olean

Shenango sandstone, which belongs to the same age as the rocks under discussion.

A lucid description of the manner in which the several members of this variable series of rocks change in character and in their relations to each other, and the exact outlines of their geographical boundaries, would be a task requiring many explicit details and a great deal of graphic illustration. We can in this place only attempt a very general summary of the facts which the drill has incidentally disclosed, in spite of the persistent and unpardonable indifference of oil operators to the study of the strata above the oil group.

The *red shale bed* is deserving of more attention than it has hitherto received, for it is an important guide to the driller, and an exceedingly interesting stratum for geological study. It is due, as has been shown above, among the shaly deposits which measure about 180′ in thickness and fill the interval between the First oil sand and the Berea grit; but does not always appear in the same part of them. In some places it reposes directly upon the First oil sand; in others, forms the floor upon which the Berea grit rests; but more frequently lies imbedded irregularly between the two sandstone horizons, with varying thicknesses of bluish gray shales both above and below it.

In Pennsylvania its maximum thickness varies from 80 to 120 feet in the counties of Forest, southern Venango, and western Butler; but at Tidioute in Warren Co., where its horizon is plainly exposed in the river hills, not a trace of red is to be seen. The hundred-foot red at Oil City and Franklin, fades out completely and disappears before reaching Edenburg in Clarion Co., as was shown on Plate VI, Report I³. From Edenburg to Waynesburg, in Greene Co., it nowhere appears over the axis of the oil group; neither is it present at Pittsburgh, nor in the Westmoreland gas fields. Beyond the producing regions, however, in eastern Clarion, and in Jefferson, a similar red, occupying the same horizon, is sometimes found.

By far the larger part of this deposit lies in Ohio where, as a red shale, it can be traced as far west as its

outcrop along the Cincinnati anticlinal, and as far south as northwestern Kentucky. The accompanying sketch, Plate No. 5, shows the peculiarly shaped area under which it is known to exist in thickness of from 10′ to 120′, as reported by oil well drillers. Probably more than 15,000 square miles are included within the indicated limits.

Its northerly and westerly outlines are well authenticated by facts obtained from drill holes and outcrops; and its southeasterly boundary cannot be seriously questioned; for we know that this red does not overlap the Butler-Washington oil field in Pennsylvania; that only a trace of it appears in wells in the vicinity of Wheeling; that it fails entirely in the Macksburg and West Virginia oil fields, where many wells have been sunk below its horizon; and that similar reports come from all the deep wells farther south—at Marietta, Pomeroy, and Gallipolis in Ohio, at Charleston in West Virginia, and in Lawrence Co. in Kentucky.

There seems, then, to be no untested interval along the southeastern line where the red-sediment-bearing currents of the east could have had free communication with this basin, except through a narow channel in Forest Co., Pa. At least, that is the only place discernible where the deposits are continuous from east to west.

The thickness of the red shale bed in Ohio and its position in relation to the Berea grit are shown by the following selections from the many well records given in the Geological Survey of Ohio, Vol. VI.

		Thickness of Red shale	*Distance below Berea grit.*
New Lisbon,	Columbia county,	90	75
Canton,	Stark "	14	0
Wooster,	Wayne "	108	0
Medina,	Medina "	54	0
Wellington,	Lorain "	96	8
N. London,	Huron "	107?	?
Mansfield,	Richland "	35	15
Crestline,	Crawford "	30	65
Mt. Vernon,	Knox "	120	0
Newark,	Licking "	40	3
Shawnee,	Perry "	40±	?

			Thickness of Red shale.	*Distance below Berea grit.*
Logan, ...	Hocking	county, ...	100±	0
Bloomingville, .	Hocking	"	81	12
Portsmouth, . .	Scioto	"	50	0
Ironton, ...	Lawrence	"	15	75
To which may be added,				
Guffey well, . .	Grayson	" Ky., .	5	25

The Butler Gas Sand comes next in order. No reference to this sand is found in any of the well records north of Petrolia. It first appears in the neighborhood of Karns City, where the drillers called it the "Thousand-foot shell," because it was thin and hard, and lay about 1000′ from the surface. Increasing in thickness towards the southwest it was frequently mistaken for the First oil sand and so designated in many well records. Later, when it asserted itself as a pronounced gas bearer, it came to be known as the Butler gas-rock. Along the axis south of Butler, it is a very persistent stratum. Thinning towards the west it generally becomes unrecognizable as a sandstone before the line of red shale deposits is reached, but holds its place with remarkable persistency over a wide sweep of country to the southeast; being sometimes a gas rock, as at Lardin town and East Pittsburgh, and sometimes a salt water bed, as at South Pittsburgh and Murrysville.

This sand appears to be an extensive deposit, and owe its existence to the continuance of the same peculiar conditions that cause the superabundant deposits of sand beds in the Butler oil group in this region, as previously mentioned; and if the facts have been correctly interpreted, its geographical limits probably coincide very nearly with the outlines of the underlying Southern oil group.

The Berea grit of Ohio, identified with the Pithole grit of the Oil Creek region in Pennsylvania (See Report I³ Plate IV) next demands consideration. As an oil-bearing rock in our State it is, comparatively, of little value, having been productive only in a few limited pools in Mercer, Lawrence and Beaver counties; but in eastern Ohio, it is a very important stratum, as may be seen from the following ex-

tracts from Prof. Orton's exhaustive discussion of its outcrops, dips and constitutional characteristics, in the Geological Survey of Ohio, Vol. VI.

(a) "We have reached in our review the Berea grit, the second element of the Waverly series, and not only the most important member of the series, but by far the most important single stratum in the entire geological column of Ohio. Its economic value above ground is great, but it is greater below. In its outcrops it is a source of the finest building stone and the best grindstone grit of the country; and when it dips beneath the surface it becomes the repository of invaluable supplies of petroleum, gas and salt water. Its persistence as a stratum is phenomenal. Seldom reaching a thickness of fifty feet, its proved area in Ohio above ground and below, is scarcely less than 15,000 square miles; and beyond the boundaries of Ohio it extends with continuity and strength unbroken into at least four other adjacent states. As a guide to the interpretation of our series, and especially as a guide in our subterranean geology, it is invaluable. . . . . .

(b) "The Berea grit is the first regular sandstone to be reached in ascending the geological column of Ohio, and by the same token the last regular sandstone found in descending the scale. The Hillsborough sandstone, the Sylvania sandstone, and the Upper Helderberg sandstone, occur in infrequent and irregular deposits, inter-stratified with the limestones to which they respectively belong; and while they appear in one section they are wanting in a thousand. The Berea grit, on the other hand, is absolutely continuous, and is always definitely characterized as a sandstone. It overlies the greatest shale formation of the entire state, viz., the Ohio shales, which, taken together, range in thickness from 300 to 2000 feet. The Bedford shale is blue, or red in color, the latter color being, wherever it occurs, an excellent mark of the formation. The Ohio shale consists of inter-stratified black and blue or gray bands. This is the series that is found below the Berea grit. The formation is as definitely marked by the strata that cover it. Its immediate roof is the Berea shale, a firm, fine-grained, highly

petroliferous black shale, the lower part of which generally carries a pyritous band of a few inches or one or two feet in thickness, and which is excessively hard. . . .

(c) "From the shore of Lake Erie near Cleveland, its outcrop passes southward and westward, with a breadth varying between one and ten miles, through Cuyahoga, Erie, Huron, Richland, Crawford, Morrow, Delaware, Franklin, Pickaway, Ross, Pike, Highland, Adams, and Scioto counties, to the Ohio Valley. It is almost everywhere distinct and unmistakable, and gives rise to a large number of quarries small and great along the line. . . .

(d) "From the line of outcrop already given the stratum dips prevailingly to the southeast and south, the descent ranging from fifteen to fifty feet per mile. Its lowest levels are found under deep cover in the Ohio Valley between Marietta and Steubenville. The lowest recorded levels are about 800 feet below tide. . . .

(e) "The sandstone grows steadily finer as it is followed southward from northern Ohio, and at the same time it becomes more impure; but even in the Ohio Valley it does not lose the character of a grindstone grit. . . .

(f) "It lies buried in a composite mass of shales; and in the largest part of the area occupied it is absolutely the only sandstone that belongs in this portion of the shale. There is no stratum that can dispute with it the place in which it occurs. More than this, the roof of the sandstone is black and hard, while the floor is always soft and often red." "In northeastern Ohio the series is somewhat complicated both in outcrop and under cover, but there are points enough here to afford means for safe identification in most instances. . . .

(g) "The Berea grit is a representative oil rock. The presumption in regard to it, in any portion of the State in which it lies below the surface, is that oil, gas, or salt water, one or two or all, will be found in it in appreciable amount when it is reached by the drill. In a field of a few square miles it has been found to contain so large a stock of oil that its production for a year exceeded 2500 barrels per day; and at many points a small production has been established

from it; in several fields it has been found charged with high-pressure gas, and at very many points with low-pressure gas; in others it has been a productive source of brine for the manufacture of salt, and also of bromine, and generally in connection with more or less vigorous supplies of natural gas."*

These quotations show the character, habits and associations of the rock in Ohio and some comparisons may be made from the following facts: the Berea grit, varying in thickness from 10′ to 50′ underlies all the eastern portion of Ohio; it is a well-defined, persistent and easily-recognized sandstone, but grows finer and more impure when followed through the Ohio Valley; it is the last regular sand pierced by the drillers of deep wells in eastern Ohio; beneath it comes the great Ohio shale formation ranging in thickness from 300′ to 2000′ and containing no regular sandstones.

The section stands thus:

Berea grit,	10′ to 50
Ohio shale, top sometimes red,	300′ to 2,000
Hamilton limestone.	

We need go but a little way into Pennsylvania to find a radical change in this stratigraphy. Take the record of the Conway well before referred to for instance:

Berea grit,	No. X	15
Slate and shale, bottom red,	No. X (and IX?)	200′
Venango Oil Sands,	No. IX	300′
Devonian slates and shales,	No. VIII	3230′
Hamilton limestone.		

Farther northeast the changes are still greater, for the Warren, McKean and Elk sands come into the section in formation No. VIII making at least 12 massive oil and gas-bearing sandstones ranging from 15′ to 100′ in thickness, below the horizon of the Berea grit. And even in Beaver county and across the Ohio line, at least one quite persistent deep sand is reported lying more than 400′ below the Berea grit.

The sandless shales of the Ohio section completely fill the interval between the Hamilton limestone and the Berea grit

* Geological Survey of Ohio, Vol. VI. (a) page 35; (b) p. 312; (c) p. 311; (d) p. 312; (e) p. 311; (f) p. 314; (g) p. 325.

and therefore represent the same measure of time in their formation as the shales and inter-stratified sandstones of the Pennsylvania section, since they fill the same interval. As they commence in the lower part of Formation No. VIII and end in the lower part of No. X, the deposits evidently belong, in part, to three distinct periods. In Ohio the conditions of sedimentation appear to have been remarkably uniform and no very conspicuous variations in the character of the deposits occur to mark positively the transition of No. VIII to No. IX or of No. IX to No. X, unless the Bedford shale be recognized as the distinctive representative of No. IX. But in Pennsylvania an abrupt change from the homogeneous shales of No. VIII to the massive oil sands of No. IX is plainly recorded. The transition from No. IX to No. X, however, seems to have been effected more gradually; and in some localities the line of demarkation between the two formations is rather obscure; still there are generally sufficient lithological and palæontological proofs at hand to show the approximate horizon in which the change occurred.

It is seen from this that the sands of the Pennsylvania oil group do not extend westward into Ohio in a productive form, a fact entirely consistent with and confirmatory of the theory that they belong to Catskill age—their westward bounds having been definitely established by the same physical agencies that destroyed Chemung conditions over parts of the ancient basin, and outlined the new shores and currents of the succeeding Catskill sea.

Should a line be traced along the westerly outline of the Venango-Butler oil sands from Greene county to southeast Crawford, and be thence extended through the northeast corner of Warren, it would mark a limit towards the west and northwest beyond which none of the regular sands of the several oil groups above mentioned are likely to be found in normal condition by deep drilling. Where these oil sands fade in that direction their disappearance is final, they never come in again in these western shales. It is to be remarked, however, that traces of some of the lower sands of the Butler group are occasionally found under the

red shale basin in Beaver county as far west as the Ohio river.

But the Berea grit was evidently deposited under very different conditions from those which obtained during the deposition of the Venango-Butler group; for, by far the greater part of it lies west and northwest of the ranges of this group as shown by the quotations above. Entering Pennsylvania from the west, it has been traced and discussed by Prof. White in his reports, as a variable and generally thin-bedded or flaggy sandstone throughout the western tier of counties north of the Ohio river. Its horizon has been well established by well records from New Castle to Tidioute, and as far south as a line from Beaver Falls to Parkers, on the Butler belt. Under all this country its identification with the Pithole grit (the so called First sand of the Pithole drillers) is unquestionable and conclusive. On Oil Creek and along the Allegheny River from Oil City to Tidioute it is boldly exposed in hundreds of places, and may be studied in detail. It is there a 20′ to 30′ stratum of irregularly bedded sand layers, with thin shale partings; is not very clearly defined either at top or bottom, by reason of the sandy materials in which it is embedded; and frequently contains irregular layers or lenticular patches of limestone which give 30 per cent. of carbonate on analysis. At Tionesta it is seen to have shrunken and deteriorated; and farther eastward, in Forest county, becomes unrecognizable in oil wells—at least the drillers do not deem it worthy of notice.

It is hardly supposable that the Berea grit will be overlooked by the driller in any well where it is fairly developed, since he considers it the first important sandstone to be noted wherever the Mountain sands are pierced. Knowing that the thickness of the latter is variable and dependent upon the location of the well, he never feels sure of his calculations until after passing them all he has drilled through about 200′ of slate. Then his First sand is due, and, having found it, he knows from experience what may be expected to follow. Throughout the highlands of Venango county it has been proven a persistent and reliable key-rock. All

the early drillers were educated there, and those who led the advance into Clarion and Butler carried their northern experiences with them and very naturally looked for the same rocks there that had been found in Venango.

Drillers in Clarion county watched for and found a First sand, but it is not the stratum they supposed it to be, being the exact equivalent of what they called Second sand in the Venango hill country. The horizon of their so-called First sand was passed unnoticed, a very convincing proof that the Berea grit thins out and disappears in Clarion, as it does in Forest.

The stratification in Parker township, Butler county resembles that of the upper country, and here the drillers found the Berea grit lying about 300′ below the Mountain sands, and 175′ above the oil group, and called it First sand. Consequently the true First sand became the Second in the Butler district, which name adhered to it and followed developments south along the belt, until the thickening of the sand suggested the name of Hundred-foot. The Berea grit, or so-called First sand, however, soon became indistinct, and other more pronounced sandstones came in both above and below its horizon. In some wells the upper one was called First sand, in others the lower, making the interval between First and Second to vary in different localities from 100′ to 400′. The cause of this irregularity in numbering the sands seems to be that the interval between Mountain sands and Oil group contains several variable sand beds in southern Butler and Allegheny, while in Northern Butler and Venango it contains only one.

We have seen above that the Berea grit thins out and disappears towards the east in Forest and Clarion. It evidently acts in a similar manner in the counties farther south; for in no place can it be detected over-riding the Butler-Washington oil fields and spreading over its eastern flank. At Sharon, New Castle and Beaver Falls it is a massive rock 75′ to 80′ thick; at Bullion, 20′; at Harrisville, Mercer township, Butler county, 16′; in Brady township, 26′; at Greece City, 20′. Here are plain evidences of shrinkage, but just where or how it fails along the range of the oil

fields cannot be shown, since the oil operator sees no utility in studying the strata above the oil sands, and it is utterly impossible to get well records kept with sufficient accuracy and detail to show the exact stratification in this variable horizon. It seems clear nevertheless, that the Berea grit becomes thin and impure towards the east; and the indications are that in Pennsylvania it seldom, if ever, overreaches the easterly limits of the underlying red shale deposits before described.

A well-defined band of sandy, slaty shale from 175′ to 200′ in thickness overlies the Berea grit in the Venango regions; but in Butler county, as previously remarked, the interval becomes much more sandy, and in some places contains quite massive sand beds. Hence its limits are not distinctly marked in Butler and the driller's well records frequently include more or less of the upper part of this division in their so-called Mountain Sands.

Chapter VII.

The Sub-Olean conglomerate, Shenango sandstone, Logan sandstone or, "Big Injun," of the Pocono formation No. X; and the Mountain limestone, Silicious limestone, or Umbral limestone of the Mauch Chunk formation, No. XI.

The Sub-Olean Conglomerate comes next in order, and belongs to the same age as the group last described, viz: Vespertine (*Pocono, X.*) Its equivalents are the Shenango sandstone of Mercer and Crawford, the Logan sandstone of Ohio, and the "Big Injun" of drillers in the southwestern corner of the state. On its northern outcrop it is a remarkably persistent stratum, seldom falling below 25′ in thickness or exceeding 50′, being in McKean and Warren a massive flat-pebble conglomerate, and in Crawford and Mercer a yellowish even-grained sandstone. Along its outcrop it lies uniformly from 30′ to 50′ below the Olean-Sharon conglomerate, the basal member of formation No. XII.

The *Shenango shales* (as they have been called in former reports) occupy this 30′ to 50′ interval, and evidently belong wholly, or in part, to the Mauch Chunk formation No. XI. Both shales and sandstones increase so materially in thickness when traced under cover towards the south east, that it seems advisable to first consider them conjointly, regardless of age, before attempting to indicate a probable plane of division between No. X. and XI.

Starting at an outcrop near the county seat of Warren county and proceeding southward, we get the following sections:

	Sub-Olean.	*Overlying Shales.*	*Total up to Olean Conglomerate.*
Warren,	30	40	70
Foxburg, N. line of Forest county,	45	170	215
Marienville, Forest county,	55	195	250
Edenburg, Clarion county (W. of line),	64	172	236
Brookville, Jefferson county (4 miles S. E.),	30	240	270
DuBois, Clearfield county (east of line),	55	320	375
Latrobe, Westmoreland county,	226	164	390

showing a large increase in thickness towards the south; and a remarkable uniformity in the Sub-Olean as far as Knox township in Jefferson county. To this point the thickening appears to be almost entirely in the overlying shale, the lower part of which, no doubt, belongs to No. X, the upper part to No. XI. No limestones are found in this country (at least the well records give no intimations of any) and there is nothing to suggest a line of division between the two formations, except some red bands, presumably of Mauch Chunk age (No. XI), which, in the Brookville section, occupy about 120′ at the top, thus dividing the shales equally between No. X and No. XI.

Several wells have been sunk between Brookville and Latrobe, but their records are defective and useless for exact comparisons. They show in a general way, however, that the Sub-Olean is thickening upwards at the expense of the overlying shales; and at Latrobe it is seen to have expanded into the great sand bed called "Big Injun" by drillers in Westmoreland, Allegheny, Washington and Greene. This name originated among drillers in Washington county, and was first applied to the thick sands at the base of the Carboniferous formation, as may be noticed in some of the Washington county well records. But, as is usually the case with such names, it has unwittingly been transferred to a different stratum by other drillers under the mistaken impression that the two rocks are identical. The Mountain limestone also appears at Latrobe (see Philadelphia Gas Company's well No. 119) accompanied by red rock, its characteristic associate at Murrysville, Belle Vernon, Carmi-

chael, and all along the southeasterly flank of the southern oil and gas field.

Returning to Warren and proceeding southwesterly we find the Sub-Olean and its overlying shales running with a good deal of uniformity through the oil wells of Venango county, but increasing somewhat in thickness at Oil City and Franklin, where the shale takes in so much siliceous material that drillers frequently treat it as a sandstone, and place the bottom of the Mountain sands at the base of the Sub-Olean-Shenango sandstone. Continuing southerly from Franklin, 100′ of sandstone and 60′ of shale are seen at Bullion; 90′ of sandstone and 72′ of shale in Brady township, Butler county; 40′ of sandstone and 75′ of shale at Beaver Falls, and 139′ of sandstone with 69′ of shale and limestone in Parkinson well, Mount Pleasant township, Washington county, where a connection is made with the same bed of limestone noted at Latrobe.

West of the above line, the Shenango sandstone is generally of less thickness than along its outcrop; and in Mercer county and the adjoining portions of Ohio, both it and the overlying Sharon conglomerate shrink almost to nothing, as seen in the following section obtained by Prof. White at the Brookfield Company's tunnel, two and one half miles southwest of Sharon (see Q, page 123):

Sharon coal,	4′
Fire clay and shales,	2′
Sharon conglomerate,	6′
Shales, bluish, sandy,	28′
Sandstone, shaly,	6′
Sandstone, hard, quartzose (Shenango SS.),	3′
Shales, bluish, sandy,	35′

Quite the reverse of this shaly section is seen on the Butler belt. There, sand beds predominate in this horizon, and the Mountain sand is represented to be from 150′ to 300′ in thickness. In one well it may end at the base of the Sharon conglomerate, in another at the base of Shenango sandstone and in another still lower. There is evidently great irregularity in the sand deposits, else the well records would be more uniform. No doubt the horizon of No. XI might be established satisfactorily, if two

or three complete sets of sand pumpings could be obtained from wells in central Butler: for probably they would show some *siliceous limestone*, which is now classed as sand. In the absence of these, the only thing to be done is to make some rough estimates by calculations based upon the Ferriferous limestone and the First oil sand.

On the plates above referred to (Chapter V of 1886) the measurements from the *Ferriferous limestone* to the base of the Shenango sandstone and to the top of the true First sand are given as follows:

Bullion, ...	to	base	of	SS	485′	Shale	385′	=	870′	to	top	of	First	sand.
Brady township,	"	"	"	"	485′	"	400′	=	885′	"	"	"	"	"
Petrolia, . . .	"	"	"	"	572′	"	344′	=	916′	"	"	"	"	"
Thorn Creek, . .	"	"	"	"	604′	"	345′	=	949′	"	"	"	"	"
Pittsburgh, . . .	"	"	"	"	555′	"	406	=	961′	"	"	"	"	"
Washington, . .	"	"	"	"	507′	"	473′	=	980′	"	"	"	"	"
Waynesburg, .	"	"	"	"	590′	"	415′	=	1005′	"	"	"	"	"

These figures show a progressive thickening of the measures between the *limestone* and the First oil sand (two points in a well record most likely to be noted correctly), but considerable irregularity in the measures above the Shenango sandstone, the latter being due no doubt to the great quantity of sandy shale in this horizon and a want of proper care in differentiating the sandstone. As an evidence of the loose manner in which well records are kept in this horizon, we append the following measurements from the *Ferriferous limestone* in seven wells on the Marshall and Wallace farms at Thorn Creek:

Marshall	3,	to	bottom	Mt.	SS	310′	Shales,	160′	SS	95′	=	565′	to	bottom	of	1st SS
"	10,	"	"	"	"	405′	"	163′	"	30′	=	598′	"	"	"	"
"	14,	"	"	"	"	426′	"	45′	"	30′	=	501′	"	"	"	"
"	16,	"	"	"	"	325′	"	160′	"	50′	=	535′	"	"	"	"
"	18,	"	"	"	"	414′	"	150′	"	40′	=	604′	"	"	"	"
Wallace	19,	"	"	"	"	440′	"	57′	"	40′	=	537′	"	"	"	"
"	21,	"	"	"	"	435′	"	130′	"	60′	=	625	"	"	"	"

No. 18 was used on the plate quoted, before the others were obtained, and (compared with them) appears to carry the Shenango sandstone too deep. But where there is so much irregularity shown, who can decide just what the typical section should be? Probably 325′ for the carboniferous and 225′ for the Shenango shales and sandstone would be a fair estimate. We then have

Shenango	shales	and	sandstone,	160′	thick	in	Bullion.
"	"	"	"	162′	"	"	Brady.
"	"	"	"	185′	"	"	Petrolia.
"	"	"	"	225′	"	"	Thorn Creek.
"	"	"	"	293′	"	"	Pittsburgh.
"	"	"	"	237′?	"	"	Washington.
"	"	"	"	395′	"	"	Waynesburg.

It is reasonably certain that the *Mountain limestone* is present as far north as Thorn Creek. Its increase is towards the south, but more on the easterly side of the oil field than on the west. At Parkinson well, Washington county, it is 42′; at Pittsburgh, 79′; and at Murrysville, 170′.

We will now review the facts given and attempt to indicate a line of division between Formation X and Formation XI. It cannot be far above the top of the Sub-Olean-Shenango sandstone along its outcrop, nor far below the Umbral reds and Mountain limestone in the wells at the south. These limiting checks define it very closely, and guided by them the sandstones, shales, and limestones which we have been tracing in the mass may be divided as follows :

	No. X.			No. XI.		
	SS.	Shale.	Total.	Shale.	Lime.	Total.
On Eastern line :						
Warren, Warren county, .	30	. . . .	30	40	. . . .	40
Foxburg, Forest county, .	45	100	145	70	. . . .	70
Marienville, Forest county,	55	100	155	95	. . . .	95
Edenburg, Clarion county,	64	90	154	82	. . . .	82
Brookville, Jefferson co.,	30	120	150	120	. . . .	120
Du Bois, Jefferson county,	55	109	164	211	. . . .	211
Latrobe, Westmoreland, .	226	. . . .	226	30	134	164
Murraysville, West. co., .	200	60	260	. . . .	170	170
Belle Vernon well, Wash.,	215	. . . .	215	. . . .	225	225
Carmichaels, Greene co., .	240	. . . .	240	10	170	180
On Western line ;						
Bullion, Venango county,	100	. . . .	100	60	. . . .	60
Brady, Butler county, . .	90	. . . .	90	72	. . . .	72
Petrolia, Butler county, .	85	. . . .	85	100	. . . .	100
Thorn Creek, Butler co., .	125	. . . .	125	80?	20?	100?
Pittsburgh, Allegheny co.,	170	. . . .	170	44	79	123
Washington, ...	152	. . . .	152	. . . .	85?	85
Parkinson, Washington co.,	139	. . . .	139	27	42	69
Waynesburg, Greene co.,	230	. . . .	230	. . . .	165	165
Gregg, Greene county, . .	300?	. . . .	300	. . . .	145	145
Weirich, Washington co.,	170	60	230	. . . .	85	85

From which it appears that the upper part of Formation No. X—the Sub-Olean-Shenango sandstone—swells from a stratum of 30′ in Warren county into a massive sandstone of 240′ in Greene county, and that the shales of No. XI, only 40′ in Warren, take in the Mountain limestone and expand to 180′ or more in Greene county—a thickening of 210′ in the sandstone and 140′ in the shales, equaling 350′ altogether. In other words, they are conjointly six times as thick in Greene county as in Warren.

Chapter VIII.

The Pottsville conglomerate, No. XII. The Allegheny coal measures, No. XIII. The Pittsburgh barren measures, No. XIV. The Monongahela coal measures, No. XV. The Washington county group, No. XVI. The Greene County barren measures, No. XVII.

The Pottsville series, or great conglomerate (formation No. XII), comes next in ascending order. In the oil regions it includes three massive sandstones all of which are conglomeritic in one place or another. (*a*) The basal member, the outcrop of which is approximately traced on the oil pool map, has been referred to in former reports under various titles, to wit :—Olean conglomerate, Garland conglomerate, Second Mountain Sand, Sharon conglomerate, Ohio conglomerate—all of which are simply different names for one and the same sand-sheet which spreads persistently over the northwestern flank of the oil fields, varying in thickness from 10′ to 80′. (*b*) The middle member, known at the north as the Kinzua Creek sandstone, and at the south as the Connoquenessing, frequently takes in shale beds and thin coal seams and divides into two or three masses, covering an interval of over 100′. (*c*) In McKean county the series is completed by the Johnson Run sandstone, and in Beaver by its equivalent the Homewood sandstone, a massive rock from 20′ to 100′ thick. — This group, like all of the others, varies considerably in diameter in different parts of the field. In McKean county it measures about 210′, in Clarion and Butler, 275′, and sometimes, where all the members are largely developed, over 300′. It is also inconstant in composition in some parts of Allegheny, Beaver and Washington, where some one or other of the sandstone horizons

is frequently filled with shale. Several instances can be cited where the Sharon conglomerate (*a*) is wanting, and the Sharon shales, with traces of coal, lie directly upon the Mountain limestones of No. XI, reducing the sandy portion of the group to about 170′, as at Pittsburgh. (See report of 1886, page 654.)

As an oil and gas bearing group the Pottsville conglomerate series in Pennsylvania is of comparatively little importance, although its basal member (*a*) has produced a little heavy-gravity oil in the Slippery Rock region of Lawrence county and at Smith's Ferry in Beaver county; and the top member (*c*, the Homewood sandstone) has furnished some good gas wells in the Hickory gas field of Washington county.

In some parts of Washington county, the group is so largely composed of sandstone, that drillers note no divisions, but include all in their *Big Sand* (or Big Injun) which is sometimes said to be 250 feet thick. It was here that the Big Injun took its name; but the Washington county rock should not be confounded with the Big Injun of the Mt. Morris district as it frequently is. At Mt. Morris the Pottsville series is not an almost continuous sandstone as at Washington, and the drillers failed to recognize their Big Sand until the Sub-Olean (there expanded into a 250′ sandstone) was reached; hence the name was misapplied.

The Manifold well near Washington (referred to elsewhere) flowed about 700 barrels per day from the so-called Big Sand, and is frequently mentioned as a producer from the same sand as the Mt. Morris wells. But this is a mistake arising from a misunderstanding of names. The Manifold oil horizon is only about 925′ below the Pittsburgh coal, while the Mt. Morris horizon is 1350′ below it. The *Big Injun* of Washington county lies *above* the Mountain limestone; the *Big Injun* of Greene county lies *below* the limestone.

The Allegheny Series (No. XIII) extends from the top of the Homewood sandstone to the base of the Mahoning sand-

stone. Its central member, the Freeport sandstone, is generally a white and massive rock, but is sometimes split up into two or three beds. When drilled through, the sand-pumpings are so white and milky that drillers frequently refer to it as the *Buttermilk rock.*

The Ferriferous limestone lies between the Freeport and Homewood sandstones; but is only important to the oil operator as an index to the depth of his well. As far as oil and gas are concerned this group may be considered practically barren.

The Pittsburg Series (No. XIV) extends from the base of the Mahoning sandstone to the base of the Pittsburg coal bed. Only the bottom member of this series (the Mahoning sandstone) is oil bearing, and that only in a very small portion of the area where it is under sufficient cover for protection. From its outcrop as (shown on the oil pool map) it sinks to a depth of over 1800′ in Greene county, and has been perforated in many hundreds of places; yet no considerable amount of oil has been produced from it; and only in the Dunkard Creek region of Greene county and at Pleasant Unity in Westmoreland county have paying wells been obtained.

The only other rock in this group of interest to oil men is the Crinoidal limestone which lies about in the center of it. It is generally associated with caving red-shales which give well drillers a good deal of trouble, as mentioned in Chapt. IX.

The Monongahela series (No. XV) extends from the base of the Pittsburgh coal bed to the top of the Waynesburg sandstone. It is not oil bearing. For a detailed description of its several members, see Report K, page 57.

The Washington County Group (No. XVI) extends from the top of the Waynesburg sandstone to the top of Limestone No. VI (Washington Upper Limestone). This also is not oil bearing and covers only a comparatively small area in the southwestern part of the state. See Report K, page 45.

The Greene County Group (No. XVII) extends from the top of Limestone No. VI to the surface, covers a much smaller area than the preceding group, and is likewise non-oil-bearing. See Report K. page 36.

These are the newest rocks in the region, and a well drilled from the summit would require to be nearly 4000 feet deep to reach the horizon of the Third sand of Oil Creek. On plate No. IV a vertical distance of 3500′ is given, but an allowance must be made for the thickening of the horizons of the Mountain limestone and Sub-Olean conglomerate, and also for variations in the other formations.

Chapter IX.

Generalized Columnar Section of all the formations from surface of XVII in Greene County down to the Corniferous limestone horizon at the bottom of VIII. Old plate No. 11, corrected into new plate No. 4.

A vertical section of the stratified rocks of Western Pennsylvania, extending from the top of the Upper Barren Coal Measures in Greene county down to the Corniferous limestone was published in 1880, as Plate XI in Report III, Chapter XVII. Since that time, many new oil and gas pools have been discovered and developed; several sand rocks not then noted as oil bearers have been added to the productive list, (the Elk group, the lower sands of the Warren group and the Sub-Olean conglomerate or Big Injun); and important accessions to our knowledge of the underground structure of the oil regions have been acquired through a study of the records of many deep wells which now furnish established facts to take the place of former theoretical deductions. It seems desirable therefore that the section referred to should be republished with additions and corrections, so that it may present the facts as they are known at present. To this end the principal part of Chapter XVII is here reproduced with such explanatory notes as are required to adapt it to the new section, Plate No. IV.

Extracts from Report III.

§ 341. A grave misapprehension exists in the minds of many oil producers regarding the true relationship of the oil rocks of one locality to those of another. Because it can be shown on a map that nearly all of the oil-producing areas of Pennsylvania, Ohio and West Virginia are included within the limits of a comparatively narrow general belt of country, stretching from northeast to southwest, it

is taken for granted by those who do not stop to reason much about it, that the oils of different localities along this general belt are all produced from one and the same series of rocks.

This erroneous idea has given occasion to a great deal of injudicious drilling along lines run merely to connect a district producing oil from one horizon, with another district producing oil from a higher or lower rock.

§ 342. When *Bradford* first began to give signs of promise as an oil field, the map of western Pennsylvania being consulted, the embryo development was found to be on a nearly direct continuation of the Clarion county oil belt. Immediately several transit lines were started by different parties and run through from the old to the new ground. Each surveyor had his own particular angle of deviation from the meridian to run by; and each one, as far as possible, carefully kept the exact bearing and location of his line a secret.

§ 343. A statement was published at that time, and much quoted as a proof of the unerring exactness of this method of tracing an oil belt, provided the bearing of the "lead" had been properly calculated. As the story went, a "belt line expert" ran one of these lines sixty-five miles through an almost unbroken forest, employing an engineer who had never been over the country before, and who knew absolutely nothing about the work beyond the bald fact that he was traveling by a designated degree of the compass; nevertheless the line thus run conducted its fortunate projector out of the woods, down the mountain side into the valley of Tunangwant Creek, to a station within a few feet of the largest well at that time known in the Bradford district. And this termination of the line was considered by many as a conclusive proof that all the lands through which that line passed were "on the oil belt!"

§ 344. *The profile section* on Plate X*, and the *vertical section* on Plate XI, have been prepared for the purpose of exhibiting the fallacy of such views; and to enable the

* As plate X is merely an illustrative section, it is not reproduced in this report.

reader to see at a glance, what some of the fundamental features of the sedimentary structure, of the oil region especially, are.

§ 350. *The Vertical Section, Plate XI,* is intended to show that oil has been produced from ten or twelve different geological horizons in the earth's crust, ranging through a thickness of about 4500 feet of sedimentary strata. And the most skilful oil producer, the most expert geologist, cannot tell how many *other* oil horizons may exist at intermediate depths beneath the surface (*i. e.* in the scale of the formations), but which, being good only within certain geographical limits, have as yet escaped the oil miner's drill.

Notes on the above paragraphs.

Hundreds of wells—some of them deep, geologically, have been drilled at the north and around the Bradford and Allegany oil fields since 1880; the counties of Potter, Elk, Clearfield and Jefferson have been extensively explored; almost every available part of the old fields of Venango and Butler has been subjected to new tests and to deeper drilling; the Butler belt has been extended and covered with thousands of wells, spreading out southward to and across the West Virginia line, and eastward into Indiana and Westmoreland counties—still it is a remarkable fact, and one which seems to contract the range of future possibilities, that all this wide-spread drilling has brought to light no really new horizon of oil or gas delivery. Two new productive areas, but no new sand horizons, have been added to our list. The Elk county oil rock, or one belonging to the same group, was known at Smethport in McKean county in 1878, but considered unimportant and not noted on Plate XI. The Mount Morris oil sand is the representative of the Sub-Olean of the north, as shown in Chapter VII, and its productiveness in Greene county, after having proved barren in thousands of wells elsewhere, does not entitle it to be called a new find, but simply indicates that as an oil producer, it is "good only within certain geographical limits."

§ 351. The *lowest horizon** in our country from which

oil in paying quantities has been obtained is that of the *Corniferous limestone* formation, the home of the Canadian oil. This rock can be unmistakably identified at Black Rock in New York.

§ 352. The next and only other point at which the elevation of the *Corniferous limestone* can be fixed, is in the Coburn gas well at *Fredonia*, Chautauqua county, N. Y., for in our own State, as far as known, it has never been reached by the deepest borings.

Notes on the above paragraphs.

Three wells have since been drilled to the Corniferous limestone in Pennsylvania. Presque Isle well at Erie, Conway well in Venango county and Wheatland well in Mercer county. See Chapter IV.

The asterisk in § 351 referred to a note at the bottom of the page saying "oil has been found or struck at still lower horizons, but in inconsiderable quantities."

This note was intended merely as a recognition of the fact that other oil-bearing rocks were known to exist, which did not come into the discussion of the Pennsylvania fields. They had not produced any considerable quantity of oil up to that time, nor had they been systematically explored under cover; but they were mentioned as possible factors in future possibilities. Professors Winchell, Newberry and others had shown that the Hudson River formation was productive in Kentucky, and originated oil springs in Canada near Lake Huron; and Sir William E. Logan, in Geological Survey of Canada, 1863, page 788, in speaking of petroleum, used the following language: "It is, however, not improbable that farther supplies of this material may ultimately be found in other portions of the country underlaid by the Corniferous formation; and the possibility of its occurrence in available quantities in some part of the Trenton formation should not be lost sight of, although this has never hitherto furnished any considerable amount of petroleum."

These geologists put themselves on record long ago and others who had opportunities of studying the subject held

the same views. Therefore the popular fling at the profession that "the discovery of oil in the Trenton limestone was a great surprise to geologists" is unwarranted and misleading. Some geologists may have been surprised, others evidently were not.

§ 353. *The average pitch of the Corniferous limestone towards the southwest* can be calculated from its elevation at Black Rock and Fredonia, allowing us to judge approximately of the thickness of the measures between it and the Venango oil group.

At Black Rock, the exact thickness of the rock is not known. We have assumed the top to lie about 52 ft. above the surface of Lake Erie, or 625 ft. above ocean level, which cannot be far wrong.

In the Coburn well at Fredonia it is said to have been struck at a depth of 1050 ft. which (the elevation of the well mouth being 735′) puts it 315 ft. below ocean level at that place.

The distance from Black Rock to Fredonia is about 38 miles in a direction S. 35° W. and this gives an average slope or dip of about 25 ft. per mile.

But along our section line (S. 20° W.) the average dip of the limestone ought to be stronger than 25′ per mile, because the line runs more nearly in the direction of the line of greatest dip as calculated from other strata which admit of more accurate tracing. And this inference is strengthened by the fact that no limestone is reported in Jonathan Watson's deep well near Titusville.

§ 354. *The distance from Black Rock to Watson's well* is about 100 miles. Direction S. 26° W. Elevation of well mouth 1290 ft. above ocean. Depth of well 3553 ft.

On an average slope of 25′ per mile the limestone should have been found at 1875 ft. below ocean level, or 3165′ from the surface. But as no limestone was seen in the well, we must conclude either that it is absent in that locality (which is hardly probable) or that it has a greater average dip slope than 25′ per mile in that direction.

Note on the above paragraphs.

The discussion of the dips of the Corniferous limestone in Chapter IV, shows that the inferences here drawn were correct. The limestone has a greater dip from Fredonia to Titusville, than from Black Rock to Fredonia; which accounts for its non-appearance in the Watson well.

§ 356. *Localization of the oil horizons to certain areas.*—A person unacquainted with the laws of sedimentary deposition and with the methods of preparing a profile-section might inadvertantly be led to suppose, from an examination of the profile section plate X, that the different strata represented there spread out continuously and universally in every direction under the oil regions; that a well failing to produce oil in the Venango group, might be put down four or five hundred feet deeper and pump oil from the Warren group, and then five hundred feet deeper and renew itself in the Bradford "Third" sand.

But such has not been the experience of oil producers. The several groups of oil-producing rocks are locally well defined under certain areas; but they have their *geographical* as well as their geological limits, and as far as at present known, *the geographical limit of one group never overlaps that of another.*

If we take a map and outline upon it the limits of the Smith's Ferry and Slippery Rock oil-producing district—and then the Butler, Clarion and Venango—and then the Warren—and then the Bradford—we shall see that each has its own particular locus; and that the different districts are separated from one another by areas (of greater or less extent) which have been pretty thoroughly tested by the drill and proven to be unproductive.

Notes on the above paragraphs.

These statements still stand unaltered as far as *oil* is concerned. But in two localities overlaps have been found and *gas* obtained in the lower rock. In the Wilcox pool (southern part of McKean county) the Bradford sand is present and sometimes produces oil. Beneath it are two

sands of the Elk group, both of which produce gas, but no oil.

In the Speechley gas field of eastern Venango, one of the Warren sands runs under the Venango group, being about 900′ below the Third oil sand. This is also a gas sand with scarcely a trace of oil, as is attested by more than a hundred wells that have pierced it.

§ 357. *Structural variations, Plate X.*—Theoretically the structure represented in this section is correct. The horizons of the various strata of limestone, shale, and sandstone do lie superimposed one upon the other in regular order as there delineated.

But the physical constitution of these sedimentary rocks is in fact very variable. It must have been true in all ages that every deposit of sandstone in one locality must have been represented by cotemporaneous deposits of shales in other localities. Hence it happens that, in tracing rocks long distances, the sandstones disappear and shales come in at the same geological horizon.

It may not then be presumed that each particular sandstone, or its oil, will be found in every locality where its horizon can be pierced by the drill, or that a measured section of the rocks in one place can be precisely duplicated in detail in another.

Note on the above paragraphs.

The truth of these remarks is emphasized by the facts given in Chapters 5, 6, 7, and by a comparison of the well records published at the end of this report. The section is intended, simply, to show the general order and sequence of stratification, and no one conversant with the rudiments of geology will use a section of this kind as a scale of absolute measurements to test special local sections by.

§ 358. *Summary sketch of the formations exhibited in the Vertical Section, Plate XI.* This generalized section extends from the surface rocks in the Upper Barren Coal series of Greene county, Pa., down to the Corniferous

limestone the (Canadian oil rock) and will enable any one to distinguish and locate the several oil horizons thus far discovered and profitably worked in these measures.

Group No. 1.

Upper Barren Coal Measures, B.—"Greene county group." [No. XVII.] Thickness 600′.

Vertical Range.—From surface to top of Washington Upper limestone.

Composition.—Shales, sandstones, thin beds of limestone and coal.

Exposures.—The high lands of central and southwestern Greene county, Pa.

Authority.—Prof. J. J. Stevenson, Report K, p. 35, and White and Fontaine, Report PP.

Upper Barren Coal Measures, A.—"Washington county group." [No. XVI.] Thickness 350′.

Vertical Range. From top of Washington Upper limestone to top of Waynesburg sandstone.

Composition.—Shales, sandstones, limestones and thin beds of coal; but carrying also the "Washington coal bed" from 7′ to 10′ thick. In Washington county 6 beds of limestone compose about one-third of the mass, but in Greene the limestones are thin and less frequent.

Exposures.—In the highlands of Washington and Greene counties. See Report K, p. 44.

Group No. 2.

Upper Productive Coal Measures.—Thickness 475′.

Vertical Range.—From top of Waynesburg sandstone to base of Pittsburgh coal.

Composition.—Shales and sandstones with three thick bands of limestone and several thick coal beds, of which the Waynesburg and the Pittsburgh are the most important.

Exposures.—Throughout Washington, Greene and Allegheny counties. See detailed section in Prof. Stevenson's Report K, page 57.

Notes on the above paragraphs.

Group No. 2 is now called the Monongahela series No. XV.

None of the rocks of groups 1 and 2 are oil bearing, and they overlie but a small portion of the oil region, being confined to that portion of the country south of the outcrop of the Pittsburgh coal, upon which they rest. See Oil Pool Map.

Their greatest thickness is in the southwestern part of Greene county, where the drill is forced to pass through from 500 to 1600 of these barren and troublesome strata before reaching the Pittsburgh coal—when it is still more than 1800′ above the horizon of the *Gantz sand.*

GROUP No. 3.

Lower Barren Coal Measures.—Thickness 500′. [600′.]

Vertical Range.—From base of Pittsburgh coal to top of Mahoning sandstone.

Composition.—Shales and sandstones, with some thin beds of limestone and coal.

Exposures.—Partially seen in Washington and Allegheny counties and in the highlands of southern Butler; but better developed in Beaver county, where Mr. White's detailed section of these measures was taken. See Report K, pp. 75, 76.*

* Prof. Stevenson gives the section referred to above as a typical one of the Lower Barrens in Beaver county, and it will also probably hold good in a general way in Allegheny, Washington and Greene, where the exposures were so imperfect that a complete detailed section could not be obtained. But in the Dunkard creek oil wells he says "the interval between the Pittsburgh coal and Mahoning SS. is not far from 425 feet; but this interval increases northward and southwestward until in Beaver county, according to Mr. White, it is from 530′ to 540′."

He adds, on page 77 (and this is quoted to show the similarity of structure pervading all deposits of interstratified sandstones and shales, whether in the Barrens of the Carboniferous or in the Venango oil group—and in confirmation of opinions to that effect expressed in other parts of this report), "So great and so frequent are the changes in the sandstones and shales of this series, that a detailed discussion of the whole would be intelligible only by a comparison of a large number of sections; but for the most part the rocks are of so little interest or importance that such a comparison would be only a waste of time and space, edifying to neither the author nor the reader."

Notes on the above paragraphs.

The vertical range of group No. 3, now named the Pittsburgh Series No. XIV, extends from the base of the Pittsburgh coal to the *base* of the Mahoning sandstone. The belt of country covered by the outcrop of these rocks may be seen on the oil pool map, lying between the outcrops of the Pittsburgh coal and the Mahoning sandstone.

This is also an unimportant group, as far as the production of oil is concerned; but in the practical work of drilling, it occasions more trouble and expense than any group in the entire scale. It contains beds of unstable red clays which will not stand up when drilled through, but cave into the well. This makes casing necessary; and as there are still several salt water horizons below, 8-inch casing must be used to allow the insertion of the $5\frac{1}{8}$ inch required for the deeper water-veins. Where these shales are struck at 1000 or 1500 feet, the drilling of so large a hole, the cost of large casing and the risks attending its successful introduction, make practical operations very tedious, hazardous and expensive.

The *Crinoidal limestone*, occupying nearly the center of the group, is an excellent key rock to check on in studying the underlying measures, for it is nearly always recognizable, if the driller would but heed it, in every part of the field south of its outcrop, which trends irregularly across the southern townships of Butler county. Under the name of the *Ames limestone* it is known in the oil fields of southeastern Ohio and West Virginia, where it has been of great service in confirming the identifications of other strata.

The *Mahoning sandstone*, the lowest member of the series, has produced some oil in Greene, Fayette, and Westmoreland, but only three or four productive spots have been found, although it has been pierced under sufficient cover in hundreds of places in these and other counties. The Dunkard creek region in Greene county was the scene of great activity in 1865. Many wells were drilled and a few productive ones obtained, but developments as a whole were not remunerative. Two or three waves of excitement have

since swept over the district with no better results. A few good wells were obtained and some little production has been harvested, but the quantity of oil produced is very inconsiderable when compared with the output from other sands. The outcrop of this sandstone, which marks the northerly limits of the Lower Barrens (now Pittsburgh series) sweeps across the southeasterly corner of Lawrence county, the center of Butler and the southerly parts of Clarion and Jefferson, as approximately outlined on the accompanying oil pool map.

GROUP No. 4.

Lower Productive Coal Measures. Thickness 400′. [300′.]

Vertical Range.—From top of Mahoning SS. to top of Conglomerate No. XII.

Composition.—Sandstones and shales, with several good and persistent coal seams and two important beds of limestone—the "Freeport" and the "Ferriferous."

Exposures.—This series is exposed over a large extent of country in Butler, Armstrong, Clarion, Beaver, Lawrence and Venango counties. See Mr. Chance's detailed section, Report V, page 16.

Prof. Stevenson states (Report K, p. 392) that the Mahoning sandstone, the top member of this group, is the central and principal oil-bearing rock of the three sands found in oil wells on Dunkard Creek, Greene county. It also appears to be an oil-producing rock in Westmoreland county, where a number of oil and salt wells have been sunk through it.

The *Ferriferous limestone* of this group is the great limestone of Butler, Armstrong and Clarion counties and the oil miners "key rock" in sinking oil wells in these sections. It is from 5′ to 25′ in thickness and lies from 30′ to 80′ above the Homewood sandstone, the top member of Conglomerate No. XII.

Notes on the above paragraphs.

Group No. 4—now called the Allegheny series No. XIII, and extending from the *base* of the Mahoning sandstone to

the top of the Homewood sandstone (which is also the top of No. XII) has, up to the present time, yielded no oil nor gas of commercial value, although its central member (the Freeport sandstone) is a massive stratum and compares favorably in composition with our best oil sands.

As a guide to the oil well driller the Ferriferous limestone is the most important rock in this group. The general line of its outcrop may be seen on the oil pool map.

Group No. 5.

Mountain sand series, including the *Pottsville conglomerate* No. XII and probably in some localities some of the sandstones belong to the upper Pocono sandstone No. X, (No. XI being either thin, or wanting.) Thickness from 350 to 425 feet.—say 375 feet.

Vertical Range.—From top of Homewood sandstone to the base of the Olean-Garland-conglomerate, or Second mountain sand of the Venango oil wells.

Composition.—A group of variable conglomerates and sandstones interstratified with shales, and enclosing sporadic beds of iron ore and coal; two of the coal beds, the Mercer and Sharon being of great importance. It also carries in some localities two thin bands of limestone—the Mercer Upper and Lower.

Exposures.—In the highlands of Mercer, southern Crawford, Venango, Forest, Warren and McKean counties.

The lower members of this group produce heavy oil at Smith's Ferry in Beaver county, and on Slippery Rock creek in Lawrence county; and the upper conglomerate is said to be the source of some oil in Kentucky.

Notes on the above paragraphs.

Group No. 5, is now divided as follows:

Pottsville Series No. XII, extending from top of Homewood sandstone to bottom of Olean conglomerate.

Mauch Chunk No. XI, extending from bottom of Olean conglomerate to top of Sub-Olean-Shenango sandstone.

Pocono No. X, in part, namely the Sub-Olean-Shenango

sandstone. The remainder of No. X, extends down to the bottom of group No. 6.

The Pottsville Series No. XII is not under sufficient cover nor deep enough below river drainage to fit it for oil production in any of the northern counties. It first gave notice of its claims to consideration as an oil bearer, at Slippery Rock in Lawrence county, and then at Smith's ferry in Beaver county, where the oil is of heavy gravity and comes apparently from the lowest member of the group. Later, as developments pressed southward into Washington county, the upper member asserted its claims by furnishing large gas wells, and also one of the most remarkable wells in the Washington field—*the Manifold well*—remarkable on account of its great yield of oil, its long sustained production, and its immunity from interference by other wells; for, although located in a district that was thoroughly perforated, none of the neighboring wells harmed it, and all but two or three of the number found no oil whatever at this horizon and were drilled on down to the Gantz sand.

The Mauch Chunk No. XI, seldom exceeds fifty feet in thickness along its northerly outcrop, where it is simply a bed of sandy shale; but in central Butler it is reinforced by the Mountain (or Siliceous) limestone; and farther south by the characteristic reds of this division; and is thus gradually enlarged until it reaches a thickness of about 165′ in Greene county. See Chapter VII.

Only slight indications of oil and gas are found in this series in Pennsylvania, but in Kentucky and West Virginia, it seems to be an horizon of considerable promise.

The Sub-Olean Conglomerate (the top member of X), which appears to be the base of the *Logan group* of Ohio, and of the drillers' *Big Injun of Greene county*, has but little value as an oil or gas rock along its northern range. Near the southern line of McKean county it is reported to have given some evidences of oil in one or two wells, but not in sufficient quantity to indicate anything of value. In a few cases it has furnished some little gas, and three or four miles south of Brookville, in Jefferson county, several wells with a very considerable flow have been obtained.

The gas, however, has not proved of sufficient volume and permanency to satisfy even a small portion of the requirements of the town of Brookville, to which it is piped, and it is reinforced by drilling into deeper rocks. The sand rock here is pebbly but thin (say 35 feet) as compared with the 300′ Big Injun sand in Washington county and Greene, or the Logan group or Salt Water sands of Macksburg, Ohio. At Mount Morris, in the southerly border of Greene county, the *Big Injun* is largely productive of both oil and gas. As a general rule, however, this rock is heavily charged with salt water in the southern section of the state and is frequently called the *Salt Water sand.* See Chapter VII.

Group No. 6.

Crawford shales, thickness 400′ to 500′—say 450′.

Vertical Range.—From the base of the Mountain sand series to the top of the Venango oil group.

Composition.—Shales and slates, enclosing the *Pithole grit* near the center of the mass. In some localities 100 ft. or more of the lower part is composed of red shale; in others no red appears. The upper part in some sections contains quite important beds of sandstone.

Exposures.—Only favorably seen in cliffs bordering the streams in parts of Forest, Venango, Mercer, Crawford, Warren and McKean counties,—its northern outcrop being always obscured by drift.

The horizon of the *Pithole grit* appears to furnish the light gravity amber oil at Smith's Ferry and Ohioville in Beaver county, with traces of the same on Slippery Rock creek in Lawrence county. It also probably yields the heavy lubricating oil of the Mecca district in Trumbull county, Ohio. (See Chap. 8.)

Note on the above paragraphs.

The Pocono series No. X includes all of group No. 6, and also the lower member of group No. 5, as noted above; and therefore extends from the top of the Sub-Olean-Shenango sandstone to the First sand of the Venango-Butler

group. For a full description of this composite and variable series see Chapters VI and VII.

Group No. 7.

Venango Oil Group.—Thickness 300′ to 375′. Say 350′.

Vertical Range.—From the top of the *First Oil sand* (the "Second sand" of the driller in Butler county) to the bottom of the *Third Oil sand* (called the "Fourth sand" in Butler, Armstrong and Clarion, and the "Fifth sand" in some parts of Venango county).

Composition.—A group of variable sandstones, in some places conglomeritic, and locally divided into several members by irregular beds of slates and shales, some of which are red.

Exposures.—These rocks, as a group, lie, with a remarkable uniformity of slope and general structure, in a comparatively narrow belt from Herman Station in Butler county to Tidioute in Warren county. They make no conspicuous outcrops to the northwest, but appear to lose their sandy characteristics before reaching the surface.

At Tidioute the deep gorges of Dennis run and the Allegheny river expose the *First and Second Oil sands;* and as far up as Warren it is quite probable that we see the upper portion of the group exposed in the river hills. These are the only localities where a portion of the group in even an approximately normal condition may be seen above water level. Its horizon is cut through by many of the ravines of McKean county, but it has there become so changed in its physical aspects, that it disappears or becomes unrecognizable when the proper range for its outcrop is reached.

These are the oil sands of Tidioute and Colorado, Warren county; Fagundus, Forest county; Church Run and Titusville, Crawford county; and of all the well known oil centers in Venango, Clarion, Armstrong, and Butler counties.

They produce oil in different localities from the different members of the group ranging from 30° to 52° in gravity and varying greatly in color—green oil from the *Third sand* on Oil Creek; black oil from the *Stray sand* at Pleasantville;

amber oil from the *Second sand* in many places ; and dark heavy gravity oil from the *First sand* at Franklin. There are also occasional local deposits of oil shading from a light straw color to almost a jet black.

Note on the above paragraphs.

The Venango-Butler group, now recognized as Catskill No. IX, has been widely developed since the above was written, but the facts then stated still hold good as far as they go. The productive sands have been traced towards the south, almost to the West Virginia line, and many very prolific oil and gas pools have been obtained. The group undergoes some changes (as might be expected) in its southerly extension, but the only variation which requires to be mentioned here is an increase of thickness along its southeasterly flank, where it sometimes measures fully 700 ft. or twice its average in the Venango fields. For a general discussion of the group see Chapter V.

GROUP No. 8.

Interval between the Venango oil group and the Warren oil group.—Thickness 300′±.

Vertical Range.—From the base of the *Venango Third oil sand* to the top of the Warren oil group.

Composition.—Soft shale of a bluish-grey color, but containing some beds of green, purple and red, with irregular bands of thin-bedded bluish grey sandstones.

The wells at Warren, even when favorably located, do not pass through the Venango group in its normal condition, nor do the wells on the Venango belt, when sunk to the proper depth, as many of them have been, find the Warren oil shales and sands with oil ; consequently no direct measurement of this interval can be made in oil wells. In the section we have assigned a thickness to the mass which places the Venango and Warren Oil groups as near as may be in their proper relative positions vertically, at Warren.

Note on the above.

Group No. 8 is now recognized as being the top beds of

the Chemung (Devonian) formation No. VIII *g*, and the statements above need no qualifications. See Chapter IV.

Group No. 9.

Warren Oil group.—Thickness about 300 ft.

Vertical Range and Composition.—This group may be viewed as including the so-called *Second*, *Third*, and *Fourth sands of Warren:* but its composition is so variable in different parts of the district that it does not afford any persistent bands of sandstone, by which to define either its upper or its lower limit.

At north Warren the upper part is shaly; and the largest wells, it is claimed, flowed from these shales, while others got their oil from the "Third sand." At Warren the "Second sand" is fairly developed, but the oil generally comes in the "Third sand." At Stoneham a lower sand, the "Fourth" produces the oil. Thus the North Warren shales are represented at Stoneham by more sandy measures which contain no oil, and the Stoneham "Fourth sand" is poorly developed at North Warren, and unproductive. The group then may be said to extend from the top of the North Warren shales to the bottom of the *Stoneham sandstone*, covering an interval, as nearly as may be calculated, of about 300 ft.

Notes on the above paragraphs.

Since 1880, a fuller development of group No. 9, has added two more productive sands and made it necessary to extend its vertical range down to 900 feet below group No. 8. It now embraces the Warren so-called Third sand, the Stoneham-Clarindon so-called Fourth sand, the Cherry Grove-Balltown sand, and the Cooper sand. The Cooper sand appears to be the bottom member of this variable series, as no other sand beds have been found below it within the geographical range of the Warren group. As the base of the Cooper sand lies about 1200 feet below the top of the Chemung formation a vertical thickness of 900 feet has been assigned to the Warren group, in Chapter IV, where the obstacles which have prevented a more definite

and satisfactory presentation of the order and arrangement of these sands, and their relations to the McKean group, are noticed. Also see I⁴, p. 382.

Group No. 10.

Interval between the Warren Oil group and the Bradford "Third sand"—Thickness from 400′ to 450′—say 400 ft.

Vertical Range.—From the *Stoneham oil sand* to the *Bradford oil sand* ("Third").

Composition.—Slates and shales, generally of a bluish color but sometimes inclined to red or brown, interstratified with thin bands of bluish-grey, micaceous, flaggy sandstones. The sand pumpings show this interval to be very fossiliferous.

Similar difficulties are encountered in estimating the thickness of this group to those mentioned in No. 8. A large number of wells have been sunk between Bradford and Warren, but the rocks are so variable in composition and the well records have been so imperfectly kept, that no completely satisfactory identification of the rocks of the Warren oil group with their equivalents at Bradford, or of the *Bradford "Third sand"* with its corresponding stratum at Warren, can yet be made. The interval between the two oil horizons, however, appears to be in the neighborhood of 400 ft. as above given.

This interval holds the *Bradford "Second sand"* which has yielded oil in many of the McKean county wells and also the sandy-shale horizon producing "slush oil" along the Tuna Valley.

Note on the above paragraphs.

Group No. 10 covers an interval which is now included in the Warren group on the one side and the McKean group on the other, and therefore need no longer be considered as a separate division.

GROUP No. 11.

"*Bradford Third sand.*" Thickness from 20 to 80 feet.

Composition.—A fine-grained, light to dark-brown sandstone, containing pebbles the size of pin heads in some localities, while in others it is little more than a sandy-shale. It appears to be rather thin and irregularly bedded, is frequently interstratified with thin layers of grey, slaty, sandstone, and contains many fossil-shells and fish bones.

The constitutional peculiarities of the rock—its color, its composition and its structure—insure its ready recognition by the driller in any locality where he may find it in even an approximately normal condition. But this rock, like all others, has its geographical limits, outside of which its geological horizon can only be traced by the exercise of the greatest of care and the best of judgment in keeping and studying the well records.

It is seldom however that good records of wells on debatable territory are kept. The well owner always starts the drill on the presumption that the oil rock will be found. He calculates in his own way its approximate depth from the surface, and makes a contract to drill so many feet. Confident of success he urges on the drill, taking no particular note of the character of the upper rocks. But when the supposed horizon of the sand is reached and the evidences of its presence do not appear as anticipated, he discovers too late that he has nothing to check by, to ascertain whether the oil rock is actually wanting or only so changed in character as to be scarcely recognizable, or whether there may not have been some mistake in calculating its position in the well. Thus it often happens that wells of this class are abandoned, after drilling in doubt for a few days, without having been sunk to the proper depth; while others are carried on down many feet below the horizon of the sand they are in quest of; and much valuable information is lost which a little prudent foresight might have secured.

The *Bradford* "*Third sand*" may be satisfactorily located in the Wilcox wells, near the southerly line of McKean county. At Tidioute, in Warren county, thirty-five miles nearly due west from these wells, the base of the

Venango group is well defined. Between these two points—the nearest geographical approximation that can at present be made—both groups evidently undergo rapid and radical changes in composition, and the well records are vague and unreliable; hence no absolute determination of the thickness of the mass of shales lying between the two groups can here be made.

Somewhat better facilities are afforded for a study of these measures by carefully tracing the rocks from Tidioute to Warren (15 miles) and then from Warren to Bradford (25 miles). But even along these lines the structure is so obscure that mistaken identifications are quite likely to be made.

These facts are stated to explain why there is yet some uncertainty regarding the thickness of the vertical interval between the Venango oil group and Bradford "Third sand." The figures cannot differ materially, however, from those given in the vertical section.

Notes on the above paragraphs.

On the old section, Plate XI, the vertical distance from the top of the Bradford sand to the base of the Venango group, was put at the maximum at 1100 feet; but in Chapter IV we have shown that this interval at Bradford is probably nearer 1200 feet. This measurement puts the Bradford sand immediately under the Cooper sand, as seen on Plate IV. But it may be questioned whether or not they would actually lie in this position if they could be positively traced until they met. The top of the Cooper sand is sometimes brown, like the Bradford sand, and it is possible that the two sands were forming at the same time, the Cooper receiving its gray sediments from one source, the Bradford its brown from another, in which case, if the currents were coming from the northeast, as has been suggested, some brown sand might very naturally be spread over the gray, and the difference in the thickness of the masses deposited above them in localities 30 miles apart, might easily account for a measurement of 1200 in Bradford and 1100′ in Forest county. In the absence of any

positive proof in the matter we must let the section stand as the measurements make it.

Deeper drilling at Bradford has disclosed the fact that the Bradford sand, or rather the horizon in which the sand is found, is in some places about 100′ thick and therefore this interval is now assigned to the Bradford sand, although it has nowhere been reported of that thickness in one massive stratum.

The McKean group, counting the drillers' so-called First, Second and Third sands (the latter being the Bradford oil rock) measures about 700 feet in thickness, and has its principal development in McKean county, Pa., but also extends into Cattaraugus and Allegany counties, N. Y. Nowhere in Pennsylvania except in McKean county has the typical Bradford sand been found in productive form, unless it be admitted that the brown sand overlying the Cooper sand is its equivalent.

Group No. 12.

Interval between the Bradford "Third sand" and the Corniferous limestone, commencing in the Chemung and including the Portage and Hamilton groups of the New York geological survey. Thickness 1600′ ±. . . . . .

The thickness of this interval must be left questionable for reasons previously stated. We have no means of tracing the Corniferous limestone south of Fredonia, N. Y., except approximately, by its slope. The distance from Fredonia to Bradford is about 48 miles, direction about S. 45° E. A dip of 20′ to the mile would be required to place the limestone at Bradford as shown in our section.

Notes on the above paragraphs.

An interval of 400 feet from the top of Group No. 12 has been assigned to the Elk group, as mentioned in Chapter IV, and the section has also been lengthened to show the actual distance (3275′) between the Venango oil group and the Corniferous limestone, as measured in Conway well, 8 miles south of Franklin.

The Elk group comes immediately under the McKean

group. Its several sands do not spread out uniformly beneath the whole area occupied by it, which, as far as now known, lies southeast of and on a range about parallel with the McKean group. At the Wilcox gas wells there are two brown sands, both gas-bearing, lying respectively about 100′ and 200′ below the Bradford sand. In the Kane oil pool, the productive sand appears to lie still deeper, as it also does in the newly developed oil fields in Highland township, Elk county. As nearly as can be calculated at present, the brown sands of the Elk group occupy a vertical interval of about 400 feet, ending 1700 feet below the top of the Chemung formation, No. VIII *g*. See Chapter IV.

Group No. 13.

The Corniferous Limestone, probably shown in the vertical section Plate XI, in conjunction with the *Onondaga limestone.*

The composition of this group has already been referred to in the quotations given from Geology of New York.

It is the oil-producing rock of the Canadian oil regions, but at Fredonia, N. Y., yields neither oil nor gas. We may not presume therefore that it will ever be found to be an important oil horizon in Pennsylvania, and even if it should prove to be productive here, the great depth at which it lies beneath the surface must be a very serious obstacle in the way of its development.*

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* Beneath the Corniferous or Upper Helderberg limestone, lie, in regular order downwards :—Oriskany sandstone—Lewistown limestone and other Lower Helderberg calcareous rocks—Clinton red and other shales with fossil ore beds and sandrocks—Medina and Oneida sandrocks, forming many of the mountains of middle Pennsylvania—Hudson river and Utica slates—Trenton, Birdseye, Chazy and Calciferous (magnesian) limestones, forming many of the broad valleys of middle Pennsylvania and containing great deposits of brown hematite iron ore—and Potsdam sandstone, the bottom formation of the Palæozoic system.

Under these lie vast formations of chlorite and mica slates, gneisses and primary limestones, with serpentine rocks, conglomerates, porphyries, traps, and huge beds of magnetic and specular iron ore, belonging to the Cambrian, Huronian and Laurentian systems.

As the Palæozoic rocks are 20,000 feet thick in front of the Allegheny Mountain, it is probable that a well in the oil region would require to be put down a good deal deeper than 10,000 feet to strike the Cambrian floor.

Notes on the above paragraphs.

In the three wells mentioned in Chapter IV, hardly a trace of oil or gas was noticed in the Corniferous limestone. Two wells have also drilled through it in Charlotte township, Chautauqua county, New York, with similar results. A number of other northern wells which have not been reported must have reached the limestone, and many, we know, have pierced it in Ohio without obtaining any product of value. It is evident, therefore, that it cannot be considered a promising horizon for either oil or gas as far as tested.

Chapter. X.

On Oil Well Records, and the proper way of keeping them.

In preparing the following well records for publication the terms used in the originals have been retained as far as practicable. My experience is that the driller's record should never be dressed up to suit the views of the publisher. It may be imperfect, unscientific, and even inappropriate names may be used; but let the record stand as he gives it, then everyone has an opportunity of making his own deductions from it. I always distrust a record that bears the ear-marks of attempted improvements, for it is very seldom that these improvements are judiciously made; and, indeed, they are often decidedly misleading; as for instance, when the driller's "slate and shells" is persistently changed to "slate and shales." Drillers have certain terms—not classical, but expressive and well understood by the craft and by oil men generally—"Sugar-sand, clover-seed, corn-meal, blue-monday, boulder, big-injun, shells, slate and shells, soapstone," etc., and those who substitute other names should first be certain that they clearly comprehend the meaning of the originals.

A simple form has been adhered to throughout which brings out all the needed facts (as far as they may be known) plainly and without unnecessary verbiage, to wit: name of well, date of completion, location, owners, authority for facts given and elevation above ocean—followed by an unbroken chain of thickness and depths of strata drilled through. The frequent appearance of interrogation marks where descriptions of materials should be shows in what a fragmentary manner many of the records were kept. They cast no doubt upon the figures given, however, but simply indicate that the driller omitted to note what kind of rocks

filled these intervals. For instance, if the driller's memorandum reads "struck First sand at 750 feet, sand 25 feet thick; struck Second sand at 870 feet, sand 30 feet thick," it shows an interval of 95 feet between the sands—and as this is one of the links in the chain of depths it must be inserted, although the materials cannot be described.

The names of those who have kindly furnished records are given in plain Quaker fashion; and in making my grateful acknowledgments to the people of the Oil Regions for their zealous and cordial co-operation in furthering the interests of the Geological Survey and for their many personal courtesies, I desire to especially refer to them and to those which appear in a similar connection in former reports. Their numbers show the wide-spread interest that has been awakened; and also furnish a justifiable plea for my not attempting to particularize.

Many inquiries have been made, both verbally and by letter, as to the best methods of keeping well records and preserving sand-pumpings; and although these matters are referred to in report I³, Chapter XX, it may be well to reply to the questions here.

I know of no better or more convenient form for a well register than that employed in the following pages. When records are kept in this manner mistakes are not likely to occur and one always has before him the thickness of each rock-division and the depth to both its top and bottom—with the tide-water elevations, if the attitude of the well-mouth is known. Every useful fact is plainly noted in its place and no mental calculations are required when any of them are wanted.

A very common, but unsatisfactory, way of keeping a record is this:

Struck limestone at	320 feet.
Through limestone at	335 "
Top of Hundred-foot at	1200 "
Through Hundred-foot at	1280 "
Top of Thirty-foot at	1340 "
Through Thirty-foot at	1365 "
Top of Third sand at	1465 "
Through Third sand at	1500 "

How much plainer do the facts stand out, and in the same

number of lines when placed in this form, although the intervals can only be filled in with interrogation marks ?

?	320′	to	320′
Limestone,	15′	"	335′
?	865′	"	1200′
Hundred-foot,	80′	"	1280′
?	60′	"	1340′
Thirty-foot,	25′	"	1365′
?	100′	"	1465′
Third sand,	35′	"	1500′

Another popular method consists of a simple enumeration of the kind of material drilled through, with the thickness of each bed and notes of measurements when important beds are struck, thus,

Soil,	20 feet.	
Slate,	130 "	
Sandstone,	20 "	
Slate,	30 "	
Struck limestone at	220 "	
Limestone,	10 "	
Slate,	50 "	etc., etc.

This form is good, provided no mistakes occur in the original record nor in copying it from the drillers memoranda, which are generally pretty well blurred and defaced by the time the well is completed; but if mistakes should occur, there is no way of definitely locating them and the record may be ruined. In the last example, the four divisions overlying the limestone only aggregate 200 feet, yet the note says "struck limestone at 220 ft. Has one division of 20 ft. been omitted, or has a figure 5 been mistaken in copying, for a figure 3 ? It is impossible to decide or to positively locate the error. But if the record had been kept with the depths carried out in a second column and copied as below:

Soil,	20′	to	20′
Slate,	130′	"	170′
Sandstone,	20′	"	190′
Slate,	30′	"	220′
Limestone,	10′	"	230′

it would be seen at a glance that an error had been made between the depths of 20′ and 170′, and the inference would be that in the slate division 130 ft. had been copied instead of 150 ft. At any rate, the mistake is located; and even if it be suspected that one division has been omitted, the in-

tegrity of the other parts of the record can be presented in this way :

Soil,	20′ to 20′
?	20′ " 40′
Slate,	130′ " 170′

Records of this kind, even when supposed to have been kept with the greatest of care, can seldom be put into the two-column form and made to agree with the checking points mentioned or the total depth of the well, without more or less adjustment; and in some cases the discrepancies seriously affect the value of the record, or perhaps destroy all confidence in it. In this system there are no checks (or at least the driller does not take the trouble to foot up his figures as often as he should) and a mistake may readily be made and pass unnoticed until too late to properly correct it. But if the thicknesses and depths are *both* noted at the same time, one is a check upon the other; any adjustment that may be required is made at the proper time and in the proper place; so when the well is completed the record stands without a flaw. Therefore, by all means keep a consecutive register of *both* thicknesses and depths, since errors are less liable to occur in the original; and should they creep in at any time, can be corrected with confidence, and without jeopardizing the value of the whole record.

Preserving Specimens.—Wash the sand-pumpings thoroughly, until no muddy water drains from them; dry immediately, but without roasting the materials; when dry, put a couple of ounces into a small, strong paper bag; number the bags consecutively as used and note the depth (No. 7, from 125 feet to 130′); note also the character of the material enclosed, whether hard or soft, clean or muddy, and any other item that may be of interest in connection with the well; fold each bag by itself, tie in convenient packages, and they are ready to be sent anywhere by mail or express whenever required. This is, by far, the most practical way of preserving specimens at wells.

Never put specimens in common letter envelopes; they are not gummed at the corners and invariably leak.

Never send bottles to a well, for they will be filled with

wet sand-pumpings, which are good for nothing. The depths will be indistinctly marked upon the corks which may have been changed from one bottle to another, or upon labels that refuse to adhere, and when the bottles return to you some will have been broken and lost and the remainder will be found in such a hopelessly disordered condition that they cannot be studied with any satisfaction or confidence.

Never send boxes of paper, wood or tin to a well. These are very popular, and I have received and examined many specimens put up in this way. But, unfortunately, it *always* happens that all the figures are noted upon the covers. Such specimens can only be compared by opening several boxes at one and the same time, and when all the boxes are alike some of the covers are sure to get misplaced. Specimens kept in this way are always of doubtful value.

Never put samples in boxes or bags with a loose slip of paper having the depth, etc., marked upon it, for the first person who examines them is likely to make unintentional transpositions of the slips.

Never put up a shelf at the side of the derrick and make a row of little boxes to receive the sand-pumpings in rotation as they are saved, for every man who visits the well will take a pinch to examine and generally return it to the wrong apartment. By the time the well is completed the boxes contain heterogeneous mixtures which are only a delusion and a snare to those who may attempt to make deductions from them.

Never keep specimens in a box divided into several rows of small compartments, or in several rows of auger holes bored into a plank, as is sometimes the custom, for they will get mixed as mentioned above. This plan is even more objectionable than one single row of apartments, since the depths will sometimes be marked on one side and sometimes on another and when an attempt is made to arrange the material in order it is not always clear to which box the figures refer.

Never suppose that you will get a satisfactory representation of the strata drilled through by charging a glass tube with the sand-pumpings. The theory looks good, but did

any one ever see a glass tube prepared in this way, whether by a driller or by an accomplished expert, that was of any practical value? I have examined many, some of them having been prepared at considerable expense and, as supposed, with great care, but I never saw one that accomplished what was intended, or that was of any special use in studying the geology of oil wells.

I am impelled to be thus prolix in these apparently trivial matters by recollections of my experiences, of my disappointments, of my *griefs*. I have frequently driven ten or fifteen miles to examine some locally noted "complete set of sand pumpings," with the expectation, or at least the hope, of getting information on some important feature of structure not clearly brought out in the ordinary records, and always returned foiled and disheartened; having invariably found that the specimens were worthless in any special or definite study, on account of the unreliable manner in which they had been preserved.

To secure a complete set of sand-pumpings, it is necessary to save some sediment after each and every full bit run. Bag the specimens; number the bags and mark them provisionally, 3 ft., 5 ft. or whatever depth the driller thinks that bit has penetrated. Measure up occasionally at important changes in the rocks, and if the provisional measurements on the bags do not tally with the actual measurements, correct them judiciously and *re-mark* the bags permanently, keeping a written record all the while. When the samples are brought to the office and bottled for use, they can be so arranged that nearly every bottle (I use half-ounce square bottles) may represent five feet in the well, and thus, when numbered and placed side by side upon a shelf, a complete columner section of the well is presented and every portion of the material is easily accessible for examination.

The common way of saving one specimen to represent each kind of rock drilled through is good as far as it goes; but its value, of course, depends entirely upon the judgment of the driller, as he decides where one rock ends and another commences and selects the specimen which is to be

considered typical of the whole stratum. In well-pronounced beds of sandstone, limestone or slate, these selections can easily be made ; but there are horizons of mixed sediments (and they are generally important horizons) where even a geologist might make mistakes if he neglected to properly test the materials. These intervals are seldom properly represented by the drillers' samples. For instance, in localities where the *Ferriferous limestone* is very thin and shaly and lies enclosed in a bed of dark slaty shale—a specimen of the shale is preserved, the limestone is passed unnoticed, the whole mass is recorded as shale, and the position of a very important stratum is overlooked. Or in places where the *Silicious limestone* blends so deftly with the underlying sandstone and acts so much like a sandstone under the drill that it is generally counted as one continuous rock—if a sample be taken from the upper part we have a silicious limestone, if from the lower part, a pure sandstone, and neither correctly represents the whole of the stratum described in the record. Therefore, it is safer and more satisfactory, whenever the beds are of considerable thickness or at all doubtful in composition, to take specimens every ten or fifteen feet, although the naked eye can detect but little variation in the sand-pumpings.

Chapter XI.

New Well Records in the Counties of Tioga, Potter, McKean, Elk and Forest.

Billings Well No. 1.

April, 1884.

Located on the Billings farm, at Gaines, Tioga county. About sixty rods east of the A. & N. P. R. R. station at Gaines village, on Long Run. Authority, D. A. Paddock.

Well mouth above ocean in feet (A. & N. P. R. R. levels),			1265
Conductor,	13 to	13	1252
SS., hard, blue,	1 "	14	1251
Shale, blue,	4 "	18	1247
Red rock,	20 "	38	1227
Slate,	23 "	61	1204
Red rock,	48 "	109	1156
Shale, blue,	20 "	129	1136
Red rock,	40 "	169	1096
SS., gray,	2 "	171	1094
Red rock,	22 "	193	1072
Slate,	24 "	217	1048
Red rock,	23 "	240	1025
Slate and shells,	15 "	255	1010
SS., gray,	10 "	265	1000
Red rock,	20 "	285	980
Slate and shells,	17 "	302	963
" gray (salt water),	18 "	320	945
Red rock, dark,	30 "	350	915
SS., gray,	10 "	360	905
Shells and slate,	3 "	363	902
SS., hard, gray (371′ casing),	8 "	371	894
" "	2 "	373	892
Slate, black,	15 "	388	877
SS., hard, dark-gray,	9 "	397	868
Slate and shells,	20 "	417	848
" " dark hard shells,	35 "	452	813
SS., hard, gray,	26 "	478	787
Slate and shells,	40 "	518	747
SS., dark reddish,	45 "	563	702
Slate and shells,	30 "	593	672
Slate,	22 "	615	650
" and shells,	30 "	645	620

SS., gray,	10 to	655	610
Slate, soft,	18 "	673	592
" and hard shells,	7 "	680	585
" " shells,	40 "	720	545
"	25 "	745	520
Hard shells,	5 "	750	515
SS., gray,	30 "	780	485
Slate,	20 "	800	465
Shells and sand,	15 "	815	450
SS.,	31 "	846	419
Slate and shells,	43 "	889	376
Shells, hard,	12 "	901	364
Slate,	29 "	930	335
SS., gray,	50 "	980	285
" " hard,	20 "	1000	265
Slate,	60 "	1060	205
" and shells,	20 "	1080	185
"	20 "	1100	165
SS., dark-gray,	135 "	1235	+30
SS., dark, oil sand (oil and some gas),	5 "	1240	+25
" dark-gray,	26 "	1266	— 1
" gray,	19 "	1285	—20
" " slate and shells,	60 "	1345	—80

"Torpedoed with eighty quarts at 1240 feet. Some good green oil was bailed out afterwards, but salt water interfered and the well was abandoned.

Top of hill at Gaines coal mines, above ocean,	2240'
Bottom of No. XII Conglomerate,	2017'
Billings well mouth (interval composed of gray sands and red shale),	1265'"

Pike Well No. 1.

April, 1886.

Located in Pike township, Potter county, about half a mile west of the Tioga-Potter line, and forty rods north of the bank of Pine Creek; on Warrant No. 4317. Owners, Gaines Oil and Gas Co. Authority, C. G. Furman, contractor, per D. A. Paddock.

Well mouth above ocean in feet (A. & N. P. R. R. levels),			1322
Drive pipe and conductor,	37 to	37	1285
Red rock,	40 "	77	1245
Slate, gray,	20 "	97	1225
" and sand,	50 "	147	1175
Red rock,	10 "	157	1165
Sand and slate,	75 "	232	1090
Slate, blue,	56 "	288	1034
Hard shell,	10 "	298	1024
SS., light-gray,	42 "	340	982

Red rock,	10	to	350	972
SS., light-gray (salt water),	5	"	355	967
Slate (386 casing),	31	"	386	936
" and shells,	80	"	466	856
" " sand mixed,	50	"	516	806
" " shells,	40	"	556	766
SS., gray,	10	"	566	756
Slate and shells,	32	"	598	724
" " soft,	20	"	618	704
" and sand mixed,	30	"	648	674
" and shells,	40	"	688	634
SS., hard,	10	"	698	624
Slate, gray,	5	"	703	619
Hard shell,	6	"	709	613
Slate and shells,	10	"	719	603
SS., fine, light-gray, top hard, shelly,	31	"	750	572
" dark-gray,	10	"	760	562
Slate, gray,	25	"	785	537
Hard shells and slate,	40	"	825	497
SS., dark-gray (some gas),	5	"	830	492
Slate and shells,	55	"	885	437
" blue,	20	"	905	417
Hard shells,	10	"	915	407
Slate and sand, mixed,	35	"	950	372
"	25	"	975	347
SS., hard, gray,	25	"	1000	322
Slate and shells,	45	"	1045	277
SS., gray,	10	"	1055	267
Slate and shells,	50	"	1105	217
SS., soft, dark, chocolate color (oil show, salt water),	45	"	1150	172
Slate and sand, mixed,	20	"	1170	152
" soft, gray,	75	"	1245	77
SS. boulder, very hard,	10	"	1255	67
SS., dark, resembling Bradford sand (oil and gas),	12	"	1267	+55
SS., gray, slate and shells mixed to bottom,	568	"	1835	—513

"This well was torpedoed with a light shot at 1255', but did not flow within six hours. Plug was put in at 1200 feet, and an eighty-quart shot put in at 1100 feet but failed to produce anything but salt water and gas. The sand at 1255 feet was a good specimen of Bradford producing sand, with a good showing of oil and probably would have been productive had it been properly tested."

Pike Well No. 2.

August, 1886.

Located on Johnson Brook, in Pike township, Potter

county. On warrant, J. M. Kilburn, warrantee, about one mile northwest of Well No. 1, of the same Company. Owners, Gaines Oil and Gas Co. Authority, C. G. Furman, contractor, per D. A. Paddock.

Well mouth, above ocean in feet,			1437
Conductor,	10 to	10	1427
SS., hard, gray,	48 "	58	1379
Red rock,	62 "	120	1317
Slate, gray,	12 "	132	1305
Red rock,	10 "	142	1295
SS., reddish,	38 "	180	1257
Slate, blue,	15 "	195	1242
" red, soft,	22 "	217	1220
" gray (257 casing),	40 "	257	1180
" red,	60 "	317	1120
" and shells (gas),	42 "	359	1078
Red rock, soft and very red,	85 "	444	993
Slate, gray,	22 "	466	971
Red rock,	72 "	538	899
Slate, gray and sand (gas),	20 "	558	879
" soft,	45 "	603	834
Red rock,	36 "	639	798
SS., gray,	3 "	642	795
Slate, blue and shells,	23 "	665	772
" reddish,	85 "	750	687
" gray and shells,	32 "	782	655
" " " sand mixed,	35 "	817	620
" soft,	17 "	834	603
SS., light-gray, First sand.	40 "	874	563
Slate and shells,	80 "	954	483
SS., gray,	8 "	962	475
Slate, soft,	65 "	1027	410
" and shells,	47 "	1074	363
SS., gray,	13 "	1087	350
Slate and shells,	45 "	1132	305
" soft,	32 "	1164	273
Slate and sand mixed (gas),	35 "	1199	238
"	49 "	1248	189
SS., dark, reddish, Second sand,	20 "	1268	169
Slate and sand mixed,	12 "	1280	157
" blue,	32 "	1312	125
Hard shell,	5 "	1317	120
Slate, soft,	49 "	1366	71
SS., dark chocolate color, Third sand (oil show),	34 "	1400	+37
Slate and sand mixed to bottom,	100 "	1500	—63

Abandoned without being torpedoed or tested.

F. W. Andrews' Well No. 1.

June, 1887.

Located near the southwest corner of Warrant No. 2665, Hamlin township, McKean county. Authority, A. B. Howland.

Well mouth above ocean, in feet,			2133
?	90 to	90	2043
Granite rock,	40 "	130	2003
? (245′ casing),	370 "	500	1633
Red rock—more or less,	200 "	700	1433
?	200 "	900	1233
SS., coarse, white, pebbly (strong gas),	10 "	910	1223
?	660 "	1570	563
SS., white, pebbly, very hard, at		1570	563
?	423 "	1993	140
Shells, hard, at		1993	140
?	82 "	2075	58
Shells hard,	25 "	2100	+33
?	59 "	2159	—26
SS., "Bradford sand,"	15 "	2174	—41
?	87 "	2261	—128
SS., Fourth sand (smell of oil),	19 "	2280	—147
Slate to bottom,	120 "	2400	—267

Unproductive.

"Well No. 2 on Warrant 2665 (2 or 3 rods N. W. from the N. W. corner of sub-division 222 of Warrant 2663) showed same record except that the sands were not so good as No. 1."

F. W. Andrews' Well.

January, 1888.

Located in extreme S. E. corner of Warrant, No. 2703, Hamlin township, McKean county. Authority, A. B. Howland.

Well mouth above ocean, in feet,			2026
? (232′ casing),	335 to	335	1691
Red rock at		335	1691
?	1647 "	1982	44
SS., "Third sand" (5′ good sand, little gas),	8 "	1990	36
?	16 "	2006	+20
SS., "Fourth sand," 5′ red, balance gray,	30 "	2036	—10
?	20 "	2056	—30
SS., gray,	10 "	2066	—40
?	56 "	2122	—96
SS., red,	5 "	2127	—101
?	123 "	2250	—224
Shells, gray, little red on bottom,	20 "	2270	—244
? to bottom,	45 "	2315	—289

"No show of oil or gas below 1990'. This well supplies part of the gas for Mt. Jewett village."

F. W. Andrews' Well.

November, 1887.

Located on S. E. corner of Warrant No. 2692, Hamlin township, McKean county. Authority, A. B. Howland.

Well mouth above ocean, in feet,		2073
? (275' casing),	1850 to 1850	223
SS., gray (small gas),	50 " 1900	173
?	157 " 2057	16
SS., "Third sand" (strong gas in top),	14 " 2071	+2
?	84 " 2155	—82
SS., Stray,	6 " 2161	—88
?	41 " 2202	—129
SS., red and gray, "Fourth sand" (gas and smell of oil),	18 " 2220	—147
?	107 " 2327	—254
SS., top hard, bottom fair, "Fifth sand,"	10 " 2337	—264
? to bottom,	13 " 2350	—277

Unproductive.

Emery Oil Co. Well No. 1.

Drilled to Third sand December, 1883. Deepened May, 1889.

Located on Bingham lands, lot 169, Warrant 2267, Lafayette township, McKean county. Authority, Emery Oil Company.

?	2008 to 2008
SS., Bradford oil sand,	29 " 2037
? (thin sand not noted),	238 " 2275
SS., "Fourth sand," top shaly (oil),	20 " 2295
Slate and sand,	37 " 2332
SS., "Fourth sand," bottom shelly (oil),	20 " 2352
Slate,	48 " 2400

Lower sands torpedoed and well good for 15 barrels per day.

Emery Oil Co. Well No. 8.

On same warrant and 1500 feet due North of No. 1.

?	1991 to 1991
SS., Bradford sand,	29 " 2020
Slate,	205 " 2225
SS.,	5 " 2230
Slate,	93 " 2323
SS., "Fourth sand," solid sand (oil),	22 " 2345
Slate, to bottom,	28 " 2373

About the same production as No. 1.

Emery Oil Co. Well No. 48.

May, 1886.

Located on Bingham lands, lot 131, Warrant No. 2244, Lafayette township, McKean county. Authority, Emery Oil Co.

?	1984	to	1984
SS., Bradford sand,	46	"	2030
?	165	"	2195
SS., shelly (gas),	15	"	2210
?	190	"	2400
SS., (salt water filled 200′ in well),	5	"	2405
Slate, to bottom,	85	"	2490

Dent Well No. 50.

April, 1889.

Located on the Dent lands, Lafayette township, McKean county, north part of Warrant No. 3903, at forks of stream. Owners, Whitney and Wheeler. Authority, Company's books.

? (Salt water 750′ to 800′),	1050	to	1050
SS., "First sand," estimated,	30	"	1080
?	290	"	1370
SS., "Second sand" (oil show),	40	"	1410
Slate,	255	"	1665
SS., "Third sand," Bradford sand,	15	"	1680
Slate,	60	"	1740
SS.,	6	"	1746
Slate,	59	"	1805
SS., "Kane sand,"	5	"	1810
Slate,	160	"	1970
SS., "Fourth sand,"	22	"	1992
Slate, to bottom,	119	"	2111

Unproductive.

Filkins Well.

January 15, 1886.

Located near the northeast corner of Warrant No. 3782, near the Warren-McKean county-line. Authority, O. P. Boggs, contractor.

Well mouth above ocean, in feet, said to be,				1707
Drive pipe,	40	to	40	1667
Clay,	23	"	63	1644
Slate,	25	"	88	1619
SS., white, pebbly,	25	"	113	1594
Slate,	152	"	265	1442

Sand and shells,	40 to	305	1402
Slate " " (cased 355'),	50 "	355	1352
Red rock,	200 "	555	1152
SS., gray hard (little gas),	35 "	590	1117
Slate and shells,	104 "	694	1013
SS., gray,	25 "	719	988
Slate and shells,	120 "	839	868
SS., gray,	25 "	864	843
Slate and shells,	125 "	989	718
" " " dark,	180 "	1169	538
SS., gray,	15 "	1184	523
Slate and shells, dark,	135 "	1319	388
" " " light,	130 "	1449	258
" " " and sand (gas at 1500'),	70 "	1519	188
" " " light,	140 "	1659	+48
" " " dark,	97 "	1756	—49
SS., gray,	30 "	1786	—79
Slate and shells,	88 "	1874	—167
Sand " "	100 "	1974	—267
Slate,	43 "	2017	—310
Sand and shells,	43 "	2060	—353
SS., gray, and chocolate (gas),	30 "	2090	—383
Slate and shells,	70 "	2160	—453
" black,	40 "	2200	—493
SS., brown (no oil nor gas),	8 "	2208	—501
Slate, to bottom,	46 "	2254	—547

Abandoned.

Cappeau & Co. Well.

May, 1887.

Located on southwest corner Tract No. 3161, Barnet township, Forest county. Authority, the Company's books.

Conductor,	14 to	14
Slate (cased 410'),	556 "	570
Shell (little salt water),	5 "	575
?	165 "	740
Red rock,	100 "	840
SS., "Clarion sand,"	20 "	860
Slate,	50 "	910
SS., close, hard (weak gas),	15 "	925
?	25 "	950
SS., hard, gray,	20 "	970
Slate and shell,	910 "	1880
SS., "Cooper" reddish top, gray bottom (fetid gas),	55 "	1935
Slate,	270 "	2205
SS., close, reddish-gray, bastard,	18 "	2223
?	142 "	2365
SS., close, reddish-gray,	15 "	2380
? (to bottom),	48 "	2428

No show of oil.

Cappeau & Co. Well.

October 27, 1888.

Located on southwest corner of Tract No. 3773, Highland township, Elk county. Authority, the Company's books.

Well mouth above ocean, in feet (estimated),				1460
Drive pipe,	60	to	60	1400
?	165	"	225	1235
SS., First sand,	25	"	250	1210
?	205	"	455	1005
SS., shelly (water),	25	"	480	980
?	45	"	525	935
Shell (very salt water),	5	"	530	930
Slate and shells (cased 556'),	795	"	1325	135
SS., gray, fine pebbles " Darling sand,"	16	"	1341	+119
Slate and fine shells,	194	"	1535	—75
SS., "Cooper sand" top red, middle gray (some gas),	40	"	1575	—115
SS., shelly and slate,	225	"	1800	—340
Shells, sandy,	100	"	1900	—440
Slate and shells,	80	"	1980	—520
Sandy shell, reddish,	3	"	1983	—523
Shelly, no sand,	48	"	2031	—571
Sandy shell, reddish,	5	"	2036	—576
?	34	"	2070	—610
Sandy shell, reddish,	5	"	2075	—615
Shelly, and slate,	55	"	2130	—670
Slate,	10	"	2140	—680
Sandy shell, reddish,	7	"	2147	—687
Slate,	18	"	2165	—705
Shells and slate,	10	"	2175	—715
SS., shelly, reddish,	15	"	2190	—730
Shells and slate,	80	"	2270	—810
Slate to bottom,	10	"	2280	—820

"No clear sand below 1575'; only shelly sand."

Elk County Wells.

Memoranda relating to several wells in the Elk county oil field. Authority, S. B. Hughes, per A. B. Howland, September, 1888.

Name and Location of Wells.	*Warrant Number.*	*Well mouth above ocean.*	*Depth to top of sand.*
No. 1, 50 Rods N. & 50 R. W. of S. E. corner,	2019	1652 0	2186
No. 1, S. E. corner of Warrant,	2025	. . .	2395
No. 1, N. half of lot,	3664	1737 8	2272
No. 1, S. half of lot,	"	1673 0	2278
No. 1, Elk Oil Co., N. half of lot,	3663	1608 3	2244
No. 1, " " " S. half " "	"	1588 8	2272

No. 1, Clark & Foster,	2033	1687 6	2280
No. 8, Porter, Thyng & Co.,	"		2328
No. 1, Highland Oil Co.,	"		2415
No. 6, " " "	"		2444
No. 7, " " "	"		2431
No. 1, Boggs & Hunter,	2032	1735 0	2382
No. 1, Sill & Odell, mouth of 3 Mile Run,	3779	1670 4	2100
— Old "Hunter Run Well,"	3663	1590 0	2258
No. 2, Sill & Odell. S. E. corner,	3779	1920 0	2290
Ditto heavy gas in 40′ sand at			2363

Chapter XII.

New Well records in the counties of Clarion, Jefferson, Clearfield, Indiana and Cambria.

Normal School No. 1.

January, 1888.

Located on grounds belonging to the Normal School, in the borough of Clarion, Clarion county. Authority, Mr. Yengling.

Well mouth above ocean, in feet, about,			1550
?	24 to	24	1526
Slate,	16 "	40	1510
Coal,	2 "	42	1508
Slate,	40 "	82	1468
Coal,	3 "	85	1465
Slate,	57 "	142	1408
Coal,	4 "	146	1404
Slate and shells,	129 "	275	1275
SS., Mountain sand (295′ water),	120 "	395	1155
"Conglomerate" (the specimen is sandy shale),	40 "	435	1115
SS., Mountain sand (cased at 525′),	90 "	525	1025
Slate,	40 "	565	985
" red,	15 "	580	970
SS.,	70 "	650	900
Slate,	245 "	895	655
SS., "First sand,"	30 "	925	625
Slate,	88 "	1013	537
Red rock,	10 "	1023	527
Slate,	120 "	1143	407
Red rock,	25 "	1168	382
Slate,	25 "	1193	357
Red rock,	45 "	1238	312
Slate,	15 "	1253	297
Red rock,	15 "	1268	282
SS.,	25 "	1293	257
Slate,	4 "	1297	253
Shells,	3 "	1300	250
SS., Oil sand, not through,	11 "	1311	239

This was the first productive well drilled in the Clarion pool.

Cadwallader and Lord No. 1.

February, 1888.

Located in the village of Clarion, on property adjoining the Normal School. Authority, Mr. Cadwallader.

Well mouth above ocean, in feet, about,		1520
?	1225 to 1225	295
Slate,	5 " 1230	290
SS., "Boulder" (oil at 1240'),	25 " 1255	265
Slate,	4 " 1259	261
SS.,	2 " 1261	259
Slate,	5 " 1266	254
SS. (oil),	9 " 1275	245

A good well.

Blyson Run Well.

1886.

Located on Clarion river, near mouth of Blyson Run, Mill Creek township, Clarion county, about seven miles northeast from Clarion. Authority, Judge A. Cook.

Surface rock,	21 to	21
Slate and sand,	29 "	50
SS., white,	5 "	55
Slate,	20 "	75
SS.,	15 "	90
Slate,	20 "	110
SS.,	40 "	150
Slate,	126 "	276
SS.,	10 "	286
Slate,	10 "	296
SS., white (oil and salt water at 314),	18 "	314
Slate,	21 "	335
SS.,	15 "	350
Slate (a little oil at 390'),	40 "	390
" and shells,	86 "	476
SS. (oil at 480'),	18 "	494
Slate,	6 "	500
Red rock,	20 "	520
SS.,	25 "	545
Red rock,	60 "	605
SS.,	25 "	630
Red rock,	110 "	740
SS. and shells,	20 "	760
Red rock and slate,	10 "	770
SS., gas,	7 "	777
Red rock,	4 "	781
" " (2 feet Pebble sand),	7 "	788
Slate and shell,	22 "	810
SS., pebbles,	10 "	820

Slate and shells,	60 to	880	
Red rock,	25 "	905	
Slate and shells,	20 "	925	
Slate,	120 "	1045	
" and shells,	310 "	1355	
Red rock, to bottom,	12 "	1367	

Unproductive.

Cook Well No. 3.

1887.

Located at Cooksburg, Forest county, forty rods from Clarion river. Authority, Judge A. Cook.

Well mouth above ocean, in feet, about			1175
?	925 to	925	250
SS., red,	25 "	950	225
Slate and shells,	175 "	1125	50
SS., red,	25 "	1150	+25
Slate and shells,	250 "	1400	—225
SS., gray,	10 "	1410	—235
Slate and shells,	110 "	1520	—345
SS., red, mixed with slate,	20 "	1540	—365
Slate, white,	35 "	1575	—400
SS., red and slate,	25 "	1600	—425
SS., gray,	40 "	1640	—465
Slate, white,	60 "	1700	—525
SS , red (little gas),	15 "	1715	—540
Slate,	40 "	1755	—580
" and sand mixed,	30 "	1785	—610
" and shells,	15 "	1800	—625
" white,	30 "	1830	—655
" and sand mixed,	10 "	1840	—665
" white,	55 "	1895	—720
SS., red (gas),	25 "	1920	—745
" gray,	30 "	1950	—775
Slate,	6 "	1956	—781
SS., gray,	24 "	1980	—805
" black and slate,	20 "	2000	—825
Slate, dark, mixed with sand,	40 "	2040	—865
SS., black,	20 "	2060	—885
" gray and white,	6 "	2066	—891
" black,	34 "	2100	—925
Slate,	35 "	2135	—960
SS., gray,	15 "	2150	—975
Slate,	30 "	2180	—1005
SS., gray and red,	10 "	2190	—1015
Slate mixed with sand,	50 "	2240	—1065
" soft,	20 "	2260	—1085
SS., and slate mixed,	20 "	2280	—1105
Shales,	60 "	2340	—1165
Slate and shells mixed,	50 "	2390	—1215

Slate, white,	60	to	2450	—1275
SS., and slates mixed,	20	"	2470	—1295
Shales, dark,	45	"	2515	—1340
SS., dark and slate mixed,	20	"	2535	—1360
Slates and shells,	25	"	2560	—1385
SS., gray and dark slates,	40	"	2600	—1425
SS., red, mixed with slate,	20	"	2620	—1445
Slate and shells,	95	"	2715	—1540
SS., black and shells, to bottom,	11	"	2726	—1551

Unproductive.

Cook Well No. 4.

1887.

Located at Cooksburg, Forest county, 105 rods N. W. of No. 3. Authority, Judge A. Cook.

Well mouth above ocean, in feet, about,				1245
Slate,	40	to	40	1205
SS., Mountain sand,	30	"	70	1175
SS., white pebbles,	20	"	90	1155
SS., Mountain sand,	58	"	148	1097
Slate and shells mixed with sand,	92	"	240	1005
"	26	"	266	979
SS., pebbles and slate,	44	"	310	935
Slate,	45	"	355	890
SS., pebbles,	3	"	358	887
Slate,	42	"	400	845
SS., white (gas),	15	"	415	830
Slate and sand,	45	"	460	785
Red rock,	10	"	470	775
SS., and slate mixed with pebble sand,	190	"	660	585
Red rock,	10	"	670	575
" " and shells,	25	"	695	550
SS., pebbles,	7	"	702	543
Slate,	12	"	714	531
Red rock,	44	"	758	487
Slate, yellow, pebble and red rock,	87	"	845	400
SS., dark,	40	"	885	360
Slate,	60	"	945	300
SS., gray,	23	"	968	277
" red, 40; SS., gray and slate,	97	"	1065	180
" slate and shells mixed,	135	"	1200	45
" light-red,	20	"	1220	+25
" black,	55	"	1275	—30
" light,	25	"	1300	—55
Slate, soft,	120	"	1420	—175
SS., light-gray,	120	"	1540	—295
Slate and shells.	110	"	1650	—405
SS., white, soft at bottom,	63	"	1713	—468
Slate, soft,	65	"	1778	—533
SS., red (gas and oil),	27	"	1805	—560

Slate and shells,	170	to	1975	—730
SS., red,	25	"	2000	—755
" gray,	100	"	2100	—855

Stopped drilling in gray sand. Unproductive.

Laurel Oil Co. Well No. 1.

May, 1889.

Located near Cooksburg, Farmington township, Clarion county. Owners and authority, Laurel Oil Company.

Conductor,	16	to	16
Slate,	48	"	64
SS., hard, blue,	16	"	80
Slate,	105	"	185
SS., pebbly,	102	"	287
" close, white,	4	"	291
Slate,	29	"	320
SS., pebbly, and shale,	10	"	330
" white,	7	"	337
Slate,	25	"	362
Red rock,	8	"	370
Slate,	96	"	466
Shells, salt water,	22	"	488
Red rock and shells,	5	"	493
SS., gray,	184	"	677
Slate,	66	"	743
SS., "Clarion Third sand,"	44	"	789
Slate and shale,	15	"	804
SS., "Fourth," light gray, not hard,	68	"	872
Slate red and shells,	20	"	892
Slate and shells,	27	"	919
Red rock,	311	"	1230
Slate and shells,	5	"	1235
Sandy slate and shells,	255	"	1490
Slate, light, soft,	10	"	1500
SS., dark, brownish, and slate,	196	"	1696
" gray and white mixed,	33	"	1729
Slate, sandy, brownish-gray (little gas),	21	"	1750
Slate,	12	"	1762
Hard shells,	33	"	1795
Slate,	2	"	1797
SS., gray and brown, hard,	46	"	1843
Slate,	7	"	1850
SS., brownish and sandy slate,	58	"	1908
SS., red, "think Kane sand,"	109	"	2017
SS., light-gray,	17	"	2034
Slate and shell,	6	"	2040
" to bottom,	10	"	2050

Unproductive.

Jefferson Well No. 5.

1888.

Located on the D. Chitister farm, in Knox township, Jefferson county. Owners, the Jefferson Light and Heat Co. Authority, Dr. W. G. Bishop.

Well mouth above ocean in feet (Bishop),			1600
Earth,	8 to	8	1592
Fire clay,	18 "	26	1574
SS., "Bluff sand,"	138 "	164	1436
Slate,	40 "	204	1396
SS., "Mountain sand,"	247 "	451	1149
Red rock,	9 "	460	2140
SS., green,	97 "	557	1043
Slate (571′ 6″ casing),	30 "	587	1013
Red rock,	137 "	724	876
SS. (strong vein salt water),	18 "	742	858
Shells and slate (recased),	80 "	822	778
SS. (gas at 833′ and 839′),	34 "	856	744
Shells and slate,	80 "	936	664
SS.,	11 "	947	653
Slate,	9 "	956	644
SS.,	25 "	981	619
Shells and slate,	54 "	1035	565
SS. (gas at 1059′),	36 "	1071	529
Slate and shells,	132 "	1203	397
Red rock,	324 "	1527	73
Shells and slate,	68 "	1595	+5
SS. (Gas at 1600′),	13 "	1608	—8

A moderate gas well.

Bishop Well.

Feb. 9, 1888.

Located on farm of Wm. Love, warrant No. 3959, Knox township, Jefferson county. On the South branch of Swamp Run. Owners, W. G. and S. G. Bishop. Authority, the driller's record.

Well mouth said to be above ocean, in feet,			1540
Conductor,	30 to	30	1510
Coal,	2 "	32	1508
Shale,	6 "	38	1502
Fire clay,	4 "	42	1493
Shale,	8 "	50	1490
Coal,	4 "	54	1486
Slate,	46 "	100	1440
SS., Mountain sand,	370 "	470	1070
Slate,	5 "	475	1065
SS., Saltwater sand,	40 "	515	1025

Red rock (cased 520′),	20	to	535	1005
Slate,	45	"	580	960
" shells and red rock,	135	"	715	825
SS., Gas sand (best gas 725′),	30	"	745	795
Shells and slate,	89	"	834	706
SS.,	20	"	854	686
Shales,	90	"	944	596
SS.,	20	"	964	576
Slate and shells,	88	"	1052	488
SS.,	20	"	1072	468
Shale,	52	"	1124	416
Big Red rock,	235	"	1359	181
Shale and slate,	90	"	1449	91
SS.,	8	"	1457	+83
Slate and shells,	543	"	2000	—460

A moderate gas well.

Fuller Well.

Feb., 1888.

Located at the bend in Red Bank creek, near Fuller's Mill, at Brookville, Jefferson county. Owner and authority, Ira C. Fuller.

Well mouth above ocean, in feet,				1235
?	470	to	470	765
Salt water at			470	765
?	40	"	510	725
Black oil at			510	725
? (cased at 530′),	250	"	760	475
Gas at			760	475
?	35	"	795	440
Gas at			795	440
?	45	"	840	395
Red rock,	230	"	1070	165
Slate and shells,	70	"	1140	95
Red rock,	30	"	1170	+65
Slate and shells,	455	"	1625	—390
Red rock,	20	"	1645	—410
Slate and shells,	80	"	1725	—490
Red rock,	10	"	1735	—500
Slate and shells,	140	"	1875	—640
SS., gray (little gas),	25	"	1900	—665
Slate, white,	16	"	1916	—681
SS., gray, hard,	29	"	1945	—710
Slate, white,	31	"	1976	—741
SS., black,	12	"	1988	—753
Slate and shells,	257	"	2245	—1010
SS., gray,	15	"	2260	—1025
Slate, white and shells,	65	"	2325	—1090
SS., gray,	17	"	2342	—1107
Slate, white,	88	"	2430	—1195

SS. and slate, mostly sand,	40 to 2470	—1235
Slate, dark and thin shells,	53 " 2523	—1288
SS., light (some gas),	27 " 2550	—1350
Slate, light,	85 " 2535	—1400
SS., black,	25 " 2660	—1425
Slate, to bottom,	440 " 3100	—1865

Unproductive.

Falls Creek Well.

1886.

Located on the Sydney Fuller farm, near Falls Creek Station, Washington township, Jefferson county. Owners, J. M. Guffey & Co. Authority, Emmet Queen, contractor.

Well mouth above coean, in feet,		1400
Clay,	15 to 15	1385
Slate,	15 " 30	1370
Coal blossom,	1 " 31	1369
Slate,	10 " 41	1359
SS.,	60 " 101	1299
Coal,	4 " 105	1295
Slate,	220 " 325	1075
SS., white,	30 " 355	1045
" black,	60 " 415	985
Slate and shells,	75 " 490	910
SS., white,	80 " 570	830
Red rock,	15 " 585	815
Slate, white,	20 " 605	795
SS.,	200 " 805	595
Slate,	150 " 955	445
SS.,	75 " 1030	370
Red rock,	15 " 1045	355
SS.,	20 " 1065	335
Slate,	140 " 1205	195
Red rock,	25 " 1230	+170
Slate,	200 " 1430	—30
Red rock,	370 " 1800	—400
SS.,	15 " 1815	—415
Slate and shells,	300 " 2115	—715
SS.,	12 " 2127	—727
Red rock and slate,	64 " 2191	—791
SS.,	8 " 2199	—799
Slate,	250 " 2449	—1049
Red rock,	80 " 2529	—1129
SS.,	25 " 2554	—1154
Red rock and slate,	186 " 2740	—1340
SS., "Gas sand,"	40 " 2780	—1380
Red rock,	160 " 2940	—1540
Slate,	75 " 3015	—1615
SS.,	25 " 3040	—1640

Gas enough at 2750′ to run a 25 horse-power boiler.

Dubois Well.

November, 1888.

Located at the machine shop, near Dubois station (Low Grade R. R.), Clearfield county. Owner and authority John E. Dubois.

Specimen numbers.				
	Well mouth above ocean in feet, about			1405
	Gravel and quicksand,	20 to	20	1385
1.	SS.,	5 "	25	1380
	Shale,	75 "	100	1305
	Coal,	8 "	108	1297
	Shale,	90 "	198	1207
2.	Coal, very impure,	4 "	202	1203
3.	Shale, gray,	148 "	350	1055
4.	" black,	20 "	370	1035
	? (supposed to be shale),	30 "	400	1005
5.	SS., gray,	20 "	420	985
	Slate and shells,	50 "	470	935
6.	SS.,	85 "	555	850
7–8.	Red rock,	10 "	565	840
9–10.	Slate,	145 "	710	695
11.	Red rock,	30 "	740	665
	" and slate,	26 "	766	639
12.	Slate and sand,	109 "	875	530
13.	SS.,	55 "	930	475
14–16.	Slate,	230 "	1160	245
17.	SS.,	5 "	1165	240
	Slate,	70 "	1235	170
18.	SS.,	10 "	1245	160
19.	Slate,	15 "	1260	+145
20.	Red rock,	280 "	1540	—135
21.	SS.,	10 "	1550	—145
22.	Red rock,	50 "	1600	—195
23.	Slate,	68 "	1668	—263
24.	SS.,	12 "	1680	—275
	Slate,	440 "	2120	—715
25–26.	Red rock,	55 "	2175	—770
	Slate,	25 "	2200	—795
28–29.	Red rock,	5 "	2205	—800
	Slate,	19 "	2224	—819
30.	Slate,	191 "	2415	—1010
31.	SS.,	4 "	2419	—1014
	Slate,	31 "	2450	—1045
33.	SS.,	35 "	2485	—1080
	Slate,	35 "	2520	—1115
35.	SS.,	15 "	2535	—1130
36.	Slate and shells,	145 "	2680	—1275
37.	SS.,	13 "	2693	—1288
	Slate and shale,	207 "	2900	—1495

38. SS.,	50 to 2950		—1545
39. Slate and shale, to bottom,	70 " 3020		—1615
Unproductive.			

Clearfield Well, No. I.

January, 1888.

Located on J. L. McPherson's farm, on Montgomery Creek, Clearfield county, about 2 miles southwesterly from the town of Clearfield. Authority, J. Frank Snyder, Esq.

Well mouth above ocean in feet, about . . .				1160
Conductor,	29	to	29	1131
Shale,	6	"	35	1125
Coal,	1½	"	36½	
Shale (?),	33½	"	70	1090
Coal,	5	"	75	1085
?	3	"	78	1082
SS., white glass sand,*	22	"	100	1060
Coal,	3	"	103	1057
?	7	"	110	1050
SS., Mountain sand, slaty,	340	"	450	710
Red rock,	30	"	480	680
Slate,	15	"	495	665
" (505′ casing ; gas at 700′),	355	"	850	310
Sand and shells,	200	"	1050	+110
Red rock, shale,	180	"	1230	—70
SS., reddish-brown, mica (gas),	20	"	1250	—90
Slate, white and red,	55	"	1305	—145
Shells and ?	225	"	1530	—370
SS., white, fine,	42	"	1572	—412
Slate and shells,	578	"	2150	—990
SS.,	70	"	2220	—1060

*An exposure of this sandstone occurs on Montgomery creek, about 3 miles westerly from the town of Clearfield, on land of J. Linn McPherson. The following analysis, made by Prof. Otto Wurth, is kindly furnished by Mr. Snyder.

Clearfield Glass Sand

Having been washed in one hundred parts.

Silicic acid,	99.79
Alumina,	.12
Lime,	.08
Peroxyd of iron,	.014
Cobalt,	traces.
	100.004

"A very good sand for the manufacture of window and plate glass."

Slate and shells,	130	to	2350	—1190
SS., gray and dark, fine,	50	"	2400	—1240
" fine,	40	"	2440	—1280
" gray, very fine,	60	"	2500	—1340
" white, very fine,	50	"	2550	—1390
Slate,	30	"	2580	—1420
SS., gray, fine, shaly,	95	"	2675	—1515
" light-gray, fine,	5	"	2680	—1520
Slate,	70	"	2750	—1590
" and shells to bottom,	150	"	2900	—1740

Unproductive.

Saltsburg Well.

March, 1887.

Located on the Orr farm, near Saltsburg, Conemaugh township, Indiana county. Owners, J. M. Guffey & Co. Truby and Bannon, contractors.

Gravel and river sand,	18	to	18
SS., white,	15	"	33
Slate and shells,	15	"	48
Coal,	4	"	52
Fire clay,	10	"	62
SS., blue,	7	"	69
" gray,	6	"	75
Slate and shells,	13	"	88
SS., dark,	6	"	94
Fire clay,	9	"	103
Coal,	5	"	108
SS., gray,	10	"	118
Limestone,	7	"	125
SS., gray,	2	"	127
Limestone,	8	"	135
SS., gray (cased here first time),	5	"	140
Slate,	10	"	150
SS.,	15	"	165
Slate and shells,	40	"	205
SS., dark,	10	"	215
Fire clay,	5	"	220
Coal,	5	"	225
SS., gray,	8	"	233
" white (salt water),	95	"	328
Slate and shells,	15	"	343
SS., white (salt water in bottom),	147	"	490
" dark,	110	"	600
" gray (salt water),	190	"	790
Slate and shells (cased again),	50	"	840
SS., dark,	60	"	900
Slate and shells,	15	"	915
SS., white,	10	"	925
" dark,	25	"	950

SS., white,	30 to	980
" gray,	80 "	1060
Slate and shells,	35 "	1095
SS., white,	15 "	1110
" dark,	30 "	1140
" gray,	40 "	1180
" white,	10 "	1190
" red,	32 "	1222
" " very red,	4 "	1226
" light-colored, with a little slate,	169 "	1395
Sand shells,	70 "	1465
Red rock,	170 "	1635
Slate,	55 "	1690
Red rock,	35 "	1725
Slate,	50 "	1775
SS., red,	55 "	1830
Slate,	75 "	1905
"	109 "	2014

Unproductive.

Black Lick Well (No. 114).

June 13, 1887.

No. 1 on S. A. Johnston farm, Black Lick District, Indiana county. Owners and authority, Philadelphia Gas Company.

Conductor,	25 to	25
SS., dark,	50 "	75
Slate, black,	10 "	85
SS. and slate,	50 "	135
" white,	25 "	160
Slate, dark,	20 "	180
Red rock,	15 "	195
SS., gray,	35 "	230
" white,	160 "	390
" dark,	70 "	460
" white,	120 "	580
Slate, white,	15 "	595
SS., white,	65 "	660
Slate and shells, black,	20 "	680
SS., black,	40 "	720
" white (salt water and gas at 750'),	45 "	765
" black,	115 "	880
Slate, black,	85 "	965
SS., white,	20 "	985
" black, full of many colored pebbles,	5 "	990
" white,	7 "	997
" dark,	68 "	1065
" gray,	235 "	1300
Slate, red,	120 "	1420
" black,	25 "	1445
" red,	283 "	1728

Abandoned.

Cambria Iron Co. Well.

1884.

At Johnstown, Cambria county. Near Pennsylvania R. R. station. Owners, the Cambria Iron Co. Authority, the driller, per T. J. Vandergrift.

Well mouth above ocean, in feet,				1190
Drive pipe,	48	to	48	1142
Slate,	30	"	78	1112
SS., hard,	12	"	90	1100
Slate, red,	10	"	100	1090
SS.,	19	"	119	1071
Coal,	1	"	120	1070
Slate,	30	"	150	1040
SS., hard,	50	"	200	990
Slate and shells,	20	"	220	970
Coal,	3	"	223	967
SS.,	15	"	238	952
Slate,	7	"	245	945
SS., fine, blue,	65	"	310	880
Red rock,	20	"	330	860
Slate,	25	"	355	835
SS.,	10	"	365	825
" red (salt water at 400′),	45	"	410	780
" white,	35	"	445	745
Slate (mineral water at 460′),	15	"	460	730
SS., hard,	100	"	560	630
Slate,	15	"	575	615
SS. (gas at 620′, salt water at 680′),	110	"	685	505
Red rock (cased at 686′),	3	"	688	502
SS., hard,	65	"	753	437
" shelly (gas at 800′),	125	"	878	312
Slate and shells,	60	"	938	252
SS., dark,	15	"	953	237
Slate,	30	"	983	207
SS.,	75	"	1058	132
Slate,	90	"	1148	+42
SS.,	60	"	1208	—18
Slate,	45	"	1253	—63
SS.,	15	"	1268	—78
Slate,	18	"	1286	—96
SS.,	25	"	1311	—121
Slate,	50	"	1361	—171
SS.,	20	"	1381	—191
Slate,	35	"	1416	—226
Red rock,	15	"	1431	—241
SS.,	80	"	1511	—321
Red rock,	30	"	1541	—351
SS.,	75	"	1616	—426
Red rock,	340	"	1956	—766
Slate and shells (little salt water at 2130′),	200	"	2156	—966

Red rock,	25 to	2181	—991
Slate and shells,	200 "	2381	—1191
Red rock,	35 "	2416	—1226
SS.,	15 "	2431	—1241
Slate,	70 "	2501	—1311
Red rock,	30 "	2531	—1341
Slate and shells (little salt water at 2700'),	125 "	2656	—1466
Red rock, to bottom,	200 "	2856	—1666

Unproductive.

This record is published by Mr. Fulton in Appendix to Report H³, page 364; and may be found in "Atlas to Reports HH and HHH." It will be seen that the two versions do not agree, exactly, in detail. Some errors have evidently been made in copying the thickness of the different strata and carrying out the totals. Which record may be the most reliable, we have no means of determining.

Sang Hollow Well.

1884.

On Conemaugh River, 4 miles W. of Johnstown, Taylor, township, Cambria county; Laurel Hill axis. Authority, Emmet Queen, contractor.

Well mouth above ocean, in feet,			1150
Conductor,	31 to	31	1119
Slate,	19 "	50	1100
Red rock,	20 "	70	1080
SS., gray,	60 "	130	1020
Slate and shells,	20 "	150	1000
SS., gray,	70 "	220	930
Slate and shells,	10 "	230	920
SS., dark,	30 "	260	890
Slate, black and shells,	15 "	275	875
SS., dark, fine,	55 "	330	820
Slate, white,	30 "	360	790
White shell (salt water),	5 "	365	785
Slate and shells,	95 "	460	690
SS., hard,	20 "	480	670
Red rock,	20 "	500	650
Slate and shells,	18 "	518	632
SS., hard, white,	22 "	540	610
Slate and shells,	40 "	580	570
SS., hard,	15 "	595	555
Slate and shells,	105 "	700	450
SS., hard, fine,	60 "	760	390
Slate and shells (cased at 780'),	20 "	780	370
SS., hard, fine,	20 "	800	350
Red rock,	25 "	825	325

Slate and shells,	10 to	835	315
Red rock, with gas,	45 "	880	270
Slate and shells,	15 "	895	255
SS., hard, gray,	30 "	925	225
SS., red, hard,	70 "	995	155
SS., white, hard,	25 "	1020	130
Red rock,	30 "	1050	100
SS., hard, white,	30 "	1080	70
Slate,	10 "	1090	+60
SS., hard, gray,	160 "	1250	—100
Slate and shells,	85 "	1335	—185
SS., dark gray,	60 "	1395	—245
Slate and shells,	25 "	1420	—270
SS., hard,	10 "	1430	—280
Shells, red,	5 "	1435	—285
SS., hard white,	40 "	1475	—325
Slate and shells,	20 "	1495	—345
SS., gray,	25 "	1520	—370
Slate and shells,	150 "	1670	—520
SS., gray,	25 "	1695	—545
Slate and shells,	40 "	1735	—585
SS., gray,	35 "	1770	—620
Slate and shells,	55 "	1825	—675
SS., hard,	50 "	1875	—725
Slate and shells,	40 "	1915	—765
SS., hard,	60 "	1975	—825
Slate and shells,	25 "	2000	—850
SS., hard,	30 "	2030	—880
Slate, white,	15 "	2045	—895
SS., dark, hard,	50 "	2095	—945
Slate and hard shells,	30 "	2125	—975
SS., hard,	210 "	2335	—1185
Slate and shells,	70 "	2405	—1255
Slate, white, to bottom,	95 "	2500	—1350

Unproductive.

This record is also published in Appendix to Report H[3], page 367.

Chapter XIII.

New Well Records in the counties of Warren, Venango, Crawford and Erie.

McGraw Well, No. 3.

December 29, 1888.

Located on M. J. McGraw farm, Warren county. Owners, Porter and Quick. Authority, M. W. Quick.

Well mouth above ocean in feet, about				1700
Conductor, ...	21	to	21	1679
SS., ...	20	"	41	1659
Slate, ...	44	"	85	1615
SS., ...	35	"	120	1580
Slate, ...	137	"	257	1443
SS. (salt water), ...	43	"	300	1400
Slate and shells (cased 301′ 7″ with $5\frac{5}{8}$″), ...	295	"	595	1105
SS., dark, and shells, and "cap,"	5	"	600	1100
" white, good, ...	20	"	620	1080
" gray, and lower shell, ...	3	"	523	1077
Slate, ...	33	"	656	1044
SS., ...	22	"	678	1022

A small well.

McGraw Well, No. 4.

January, 1889.

Located on J. A. and W. A. McGraw farm, Triumph township, Warren county. Owners, Porter & Quick. Authority, M. W. Quick.

Well mouth above ocean in feet, about				1655
Conductor, ...	19	to	19	1636
SS., ...	70	"	89	1566
Slate and shells, ...	141	"	230	1425
SS. (salt water), ...	12	"	242	1413
Slate (248′ casing), ...	235	"	477	1178
SS., First sand, ...	17	"	494	1161
Slate, ...	36	"	530	1125
Shell, ...	1	"	531	1124
Slate, ...	16	"	547	1108

SS., Second sand,	21 to 568	1087
Slate,	30 " 598	1057
SS., Stray,	30 " 628	1027
Slate,	81 " 709	946
SS., Third sand,	7 " 716	939
Slate,	5 " 721	934
SS.,	13 " 734	921
Slate to bottom,	15 " 749	906

A small well.

Neill Well, No. 1.

1888.

Located on the Neill tract near the southeast corner of Southwest township, Warren county. Authority, J. A. Neill.

Well mouth above ocean in feet, about		1600
?	486 to 486	1114
SS., First sand,	20 " 506	1094
?	48 " 554	1046
SS., Second sand,	29 " 583	1017
?	32 " 615	985
SS., Third sand (some oil),	18 " 633	967
?	118 " 751	849
SS., Fourth sand,	4 " 755	845
Slate,	100 " 855	745

Barnum & Leasure Well.

1886.

Located on northwest corner of lot No. 444, Pleasant township, Warren county.

?	787 to	787
SS., Clarendon sand (3′ slate at 850′),	126 "	913
?	207 "	1120
SS. (oil show),	93 "	1213
?	285 "	1498
SS., barren,	75 "	1573
?	13 "	1586
Abandoned at		1586

Unproductive.

Magee & King Well.

Located on lot No. 358 Sheffield township, Warren county, west side near the middle. Well mouth about 60′ above water at Barnesville. Authority, Boon Magee, contractor.

Conductor,	92 to	92
" (cased at 210′),	658 "	750

Red rock, very red,	4 to 754
?	371 " 1125
SS. (gas),	6 " 1131
?	49 " 1180
SS. (oil show),	30 " 1210
?	135 " 1345
SS., Stray,	13 " 1358
Slate and shells (no oil or gas) to bottom,	197 " 1555

Miller & Smith Well No. 1.

September, 1888.

On John Duncan farm (formerly Sadorus), S. E. quarter of tract No. 84, Oil Creek township, Venango county. Authority, Mr. Smith.

Conductor,	22 to 22
? some red (252′ casing),	323 " 345
SS., First sand,	35 " 380
?	112 " 492
SS., Second sand,	6 " 498
?	68 " 566
SS., Stray,	12 " 578
Shells and slate,	13 " 591
?	21 " 612
SS., Third sand, pebbly,	1 " 613
Shelly slate,	15 " 628
Slate to bottom,	67 " 695

A small well of amber oil, from the First sand.

North Star Well No. 1.

February 15, 1889.

Located on southwest corner of North Star tract, Oil Creek township, Venango county, 2½ miles northwest of Pleasantville. Owners, Beebe & Newkirk. Authority, W. D. Beebe.

Drive pipe,		59 to 59
?		69 " 128
SS., Mountain sand,		40 " 168
Slate, (cased 193′),		208 " 376
SS., 10,		
Slate 15,	First sand,	33 " 409
SS. 8 (oil and gas),		
Slate,		6 " 415

Production 8 barrels per day of 47° gravity, light amber colored oil.

Homestead Well No. 1.

August 23, 1887.

Owned by A. W. Brown, and located on his premises in the borough of Pleasantville, Venango county. Authority, J. and R. Braden, contractors.

Drive pipe,	90 to 90
? (260′ of $5\frac{5}{8}''$; 765′ of $3\frac{1}{4}''$ casing),	747 " 837
SS., black oil sand (one screw good),	5 " 842
?	30 " 872
SS., green oil sand,	23 " 895
? to bottom,	45 " 940

A three-barrel oil well, and considerable gas.

Homestead Well No. 2 (Near No. 1).

April, 1888.

Conductor,	30 to 30
SS., yellow,	30 " 60
Clay shale,	110 " 170
SS., white,	80 " 250
Slate (283′ of $5\frac{5}{8}''$ casing),	115 " 365
SS., white, hard,	25 " 390
Slate,	110 " 500
Red rock,	75 " 575
Slate,	25 " 600
SS., First sand,	55 " 655
Slate,	95 " 750
SS., Second sand (gas),	20 " 770
Slate,	80 " 850
SS., Stray,	2 " 852
Slate,	28 " 880
SS., Third sand (oil and gas),	30 " 910
Slate to bottom,	52 " 962

A larger well than No. 1.

Shamburg Well.

September 10, 1888.

Located on the Benedict farm, Oil Creek township, Venango county, about a mile and a half southwest of Pleasantville. Owner and authority, Dr. George Shamburg.

Conductor,	33 to 33
Mountain sand,	100 " 133
? (cased at 217′),	317 " 450
Red rock,	5 " 455
?	75 " 530
Red rock,	5 " 535
?	30 " 565

SS., First SS. (gas at 580′, oil 593′),	28 to 593
?	100 " 693
SS. Second SS. (oil in top),	27 " 720
?	88 " 808
SS., Black oil sand, pebbly,	3 " 811
?	27 " 838
SS., Green oil sand,	24 " 862
? to bottom,	51 " 913

A small well.

Noyes Well No. 5.

1883.

Located on the Buchanan and Lytle tract, near Wrigglesworth, about 100 rods southeast of the southeast corner of Pleasantville borough. Authority, H. H. Noyes, owner.

Conductor,	12 to 12
SS.,	18 " 30
Slate,	60 " 90
Shell,	10 " 100
Slate,	70 " 170
SS.,	10 " 180
Slate,	12 " 192
SS.,	31 " 223
" gray, and slate,	10 " 233
Slate, few shells,	12 " 245
Slate (256′ casing),	205 " 450
Red rock,	8 " 458
Slate, a little red at 462′,	12 " 470
SS. "First sand,"	12 " 482
Slate,	209 " 691
SS., "Stray third" (bailed 5 bbls. of oil),	20 " 711
Slate,	29 " 740
SS., "Third sand,"	30 " 770
Slate and shells,	68 " 838
Slate,	10 " 848
SS., "Fourth sand," pebbly (oil),	8 " 856
Slate to bottom ("no Fifth sand),"	49 " 905

A small black-oil well.

Haskell & Noyes Well No. 1.

1886.

Located at "Tight Pinch," on the southeasterly part of tract No. 125, Oil Creek township, Venango county, about 3 miles south of Pleasantville. From the record of the owners.

Conductor,	32 to 32
? (266′ of casing),	585 " 617

SS., "Second sand," estimated,	20 to 637
?	68 " 705
SS., "Third, upper" (oil rose 300'),	21 " 726
?	37 " 763
SS., "Third, lower,"	25 " 788
?	75 " 863
SS., "Fourth sand" (black oil),	12 " 875
?	29 " 904
SS., "Fifth sand,"	10 " 914
Slate to bottom,	22 " 936

This well produced for a year or more, in a small way, from the lower sands, and was then torpedoed in the "Third upper," which is the upper division of the regular *Second* sand of Oil Creek, and responded to the extent of 25 or 30 barrels per day.

Since then many old wells have been cleaned out and torpedoed in this sand, new ones have been drilled into it and a very considerable production has been obtained. This new development in an old and thoroughly drilled district, where hundreds of wells have passed through the sand without obtaining anything more than "good shows" from it, may seem remarkable. But all these old holes were drilled wet (that is, standing full or nearly full of water). Second sand oil has little gas pressure, and is of a quality which quickly congeals on issuing from the rock; hence, when these old wells were drilling, the oil was held in check by the water-column, and when they were tubed and pumped from the lower rocks it made a little show at first, but coating the well-walls and closing the rock-pores, soon ceased to flow.

The wells now pumping can only be operated profitably by the judicious use of torpedoes and by arranging the pump in such a manner that the surface of the oil in the well cannot be drawn down below the top of the oil sand, for if the sandrock is not kept "flooded" or covered with oil, the production soon dwindles down to almost nothing. It is evident, therefore, that these new developments are not due to any phenomenal conditions of the oil-bearing rocks, but are to be accredited solely to the improved methods of drilling and manipulating oil wells which have been learned by a practical experience of many years.

Black Well No. 1.

August, 1888.

Located on Holmden farm, at Pithole city, Allegheny township, Venango county. Authority, Mr. Holmden.

?	550 to 550
Shells and sand, "Second sand,"	11 " 561
SS., solid, "Second sand,"	13 " 574
Slate,	35 " 609
SS., "Third sand," say,	12 " 621
Slate,	61 " 682
SS., "Fourth sand,"	8 " 690
Slate,	53 " 743
SS., "Fifth sand,"	4 " 747

Unproductive.

Salisbury Well No. 10.

September, 1888.

Located on the Salisbury farm, S. E. quarter of tract No. 114, Oil Creek township, Venango county. Owners and authority, Wilson, Palmer & McGuire.

?	480 to 480
SS., First sand, stray,	7 " 487
?	38 " 525
SS., First sand (oil show),	20 " 545
?	57 " 545
SS., Second sand stray (amber oil),	20 " 622
?	37 " 659
SS., Second sand (oil show),	16 " 675
?	78 " 753
SS. (black oil show),	16 " 769
?	23 " 792
SS. (green oil show),	19 " 811
?	52 " 863

Unproductive.

Paxton Well No. 1.

November, 1888.

Located on Paxton farm, tract No. 116, Cornplanter township, Venango county, 4 miles south of Pleasantville. Owners and authority, Porter & Quick.

Drive pipe,	25 to 25
SS.,	90 " 115
Slate,	16 " 131
SS.,	9 " 140
Slate,	99 " 239
SS. (270′ of $5\frac{1}{8}$″ casing),	21 " 260
Slate,	125 " 385

Red rock,	10 to 395
Slate,	56 " 451
Red rock,	5 " 456
SS., First sand, poor and shelly,	13 " 469
Slate,	79 " 548
SS.,	8 " 556
Slate,	3 " 559
SS. (show of oil),	5 " 564
Slate,	36 " 600
SS. (salt water),	24 " 624
Slate,	81 " 705
SS., muddy (black oil),	10 " 715
Slate,	35 " 750
Shell, showing pebbles at	750
Shelly to bottom,	10 " 760

Abandoned.

Taggert Well No. 1.

July, 1888.

On the old Humboldt property, one mile south of Plumer, Cornplanter township, Venango county. Authority, Mr. Taggert.

Conductor,	32 to 32
?	103 " 135
SS., Mountain sand (206' casing),	40 " 175
Slate (some gas at 360'),	185 " 360
SS., First sand,	40 " 400
?	3 " 403
Shell, pebbly,	1 " 404
Slate,	90 " 494
Slate, red,	8 " 502
SS., Second sand,	23 " 525
Slate,	65 " 590
SS., gray, Third sand,	8 " 598
Slate,	25 " 623
SS., pebbles,	1 " 624
Slate and shell,	22 " 646

McGrew Well No. 1.

November, 1888.

Located on Karns farm, near President, President township, Venango county. Owners and authority, McGrew Bros.

Conductor,	$14\frac{1}{2}$ to $14\frac{1}{2}$
Slate,	$5\frac{1}{2}$ " 20
SS., Mountain sand,	75 " 95
? (125' of casing),	30 " 125
Slate, soft,	34 " 159
Red rock,	80 " 239
Slate,	15 " 254

SS., First sand,	37	to	291
Slate,	48	"	339
SS., shelly, "Stray,"	20	"	359
Slate,	10	"	369
SS., "Second sand" (oil show 389'),	30	"	399
Slate,	16	"	415
SS., pebble,	10	"	425
Red rock,	10	"	435
SS., black,	1	"	436
Red rock,	5	"	441
Slate,	54	"	495
SS., "Gray rock,"	15	"	510
Slate and shells,	35	"	545
SS., black,	10	"	555
Slate,	11	"	566
SS., gray,	8	"	574
Slate,	100	"	674
Red rock,	100	"	774
Slate and shells, red,	36	"	810
Slate and shells, gray,	217	"	1027
SS., gray,	27	"	1054
Slate,	121	"	1175
SS.,	10	"	1185
Slate and shells,	75	"	1260
SS., tools struck at	20	"	1280

Abandoned.

Records of 6 well located at Raymilton, Mineral township, Venango county.

Authority, Raymond Bros.

Reagle Well.

1877.

?	630	to	630
SS., Second sand (no salt water),	12	"	642
Slate,	20	"	662
SS., Second sand, lower,	17	"	679
?	256	"	935
SS., Third sand,	4	"	939

C. H. Raymond Well.

1877.

Conductor,	14	to	14
? (cased in slate at 250'),	611	"	625
SS., Second sand,	7	"	632
Slate,	20	"	652
SS., Second sand, lower,	13	"	665
?	255	"	920
SS., Third sand,	17	"	937
?	78	"	1015

W. W. Raymond Well.

1876.

Conductor,	52 to 52
?	285 " 337
SS., First sand,	15 " 352
?	165 " 517
SS., Second sand,	7 " 524
Slate,	22 " 546
SS., Second sand, lower (torpedoed 550'),	24 " 570
?	252 " 822
SS., Third sand,	18 " 840
?	85 " 925

Old Farm Well.

1865.

Conductor,	54 to 54
?	511 " 565
SS., Second sand (oil show), say	40 " 605
?	240 " 845
SS., Third sand (some oil), say	10 " 855
?	355 " 1210

McMillen & Patterson Well.

1877.

? (cased 294'),	406 to 406
SS., First sand,	54 " 430
?	162 " 592
SS., Second sand,	21 " 613
Slate,	11 " 624
SS.,	21 " 645
?	252 " 897
SS., Third sand,	16 " 913
?	73 " 986

S. W. Reagle Well.

1872.

Located on the Johnson farm.

? (cased bottom first sand at 355'),	593 to 593
SS., Second sand, Slate, SS., Second sand, } say	50 " 643
?	240 " 883
SS., Third sand, say	10 " 893

Raymond Well No. 6.

1877.

Located on Sulphur Run, about half a mile from Sandy Creek, Mineral township, Venango county. Authority, Raymond Bros.

Conductor,	23	to	23
? (cased at 191′),	409	"	432
Red rock,	100	"	532
SS., Salt water sand,	10	"	542
Slate,	19	"	561
SS. (oil at 567′),	18	"	579
?	259	"	838
SS. Third sand,	10	"	848
?	152	"	1000
Red rock,	100	"	1100
?	250	"	1350
Shells and sand at			1350

Capt. C. H. Mason Well.

1877.

Also located on Sulphur Run (Well No. 4). Authority, Raymond Bros.

? (190′ casing),	525	to	525
SS., Second sand,	15	"	540
Slate,	20	"	560
SS., Second sand (pumped 2 bbls. per day),	8	"	568
?	302	"	870
SS., Third sand,	10	"	880
?	45	"	925

Raymond Well No. 7.

1877.

Located back of hotel, at Raymilton, Mineral township, Venango county. Authority, Raymond Bros. Elevation of Raymilton station, 1138 feet.

Well mouth above ocean, in feet, about				1150
Conductor,	23	to	23	1127
?	357	"	380	770
Red rock,	100	"	480	670
SS., Second sand (salt water 481′),	10	"	490	660
Slate,	17	"	507	643
SS.,	9	"	516	634
?	228	"	744	406
SS., Stray (oil),	12	"	756	394
Slate,	19	"	775	375
SS., Third sand,	5	"	780	370
Slate,	125	"	905	245
Red rock,	60	"	965	185
Slate,	15	"	980	170

Tools stuck at about 985′.

This well pumped 2 or 3 barrels per day for a long time.

Speechley Gas Wells.

Records of five wells in the Speechley Gas district, Pine Grove township, Venango county. Owners, Oil City Fuel Supply Co. Authority, company's record book.

Nuhfer Well No. 1 (Warrant No. 2678).

Deepened 1885.

? to bottom of old well,	1015 to 1015
Slate and shells,	873 " 1888
SS., Speechley sand; in it	14 " 1902

Nuhfer Well No. 2 (Warrant No. 2678).

Deepened 1885.

?	984 to 984
SS., Third sand, say	17 " 1001
Slate and shells,	900 " 1901
SS., Speechley sand; in it	24 " 1925

Ehret Well No. 1 (Warrant No. 2678).

Deepened 1886.

? to bottom of old well,	997 to 997
Slate and shells,	849 " 1846
SS., Speechley sand; in it,	25 " 1869

Wm. Hogue Well No. 1 (Warrant No. 2672).

December, 1885.

?	1019 to 1019
SS., Third sand,	12 " 1031
Slate and shells,	887 " 1918
SS., Speechley sand; in it	21 " 1939

Dale Well No. 15 (Warrant No. 2672).

January, 1886.

? to bottom of old well,	1205 to 1205
Slate and shells,	833 " 2038
SS., Speechley sand; in it,	22 " 2060

Miller's Well.

January, 1886.

Located opposite the water tank and about 40 feet above the railroad track, at Black's siding, Rockland township, Venango county. Owners and authority, Millers' Oil Company.

Well mouth above ocean, in feet,				960
Drive pipe,	27	to	27	933
?	356	"	383	577
Trace of Red Valley sand at			383	+577
Slate and shells,	997	"	1380	—420
SS., yellowish, fine,	60	"	1440	—480
Slate,	80	"	1520	—560
SS., slate-color (salt water and oil show),	85	"	1605	—645
Slate,	45	"	1650	—690

Unproductive.

Conway Deep Well.

Com. 1886—Comp. November, 1888.

Located on the old Witherop farm, Victory township, Venango county, close to the west bank of the Allegheny river and about 8 miles nearly due south of Franklin. Owners, Conway Brothers, of Philadelphia. Authority, driller's notes.

Well mouth above ocean, in feet,				955
Drive pipe,	48	to	48	907
"Usual drilling,"	224	"	272	683
SS., First sand,	68	"	340	615
"Usual drilling" (cased at 342),	108	"	448	507
SS., Stray second (salt water and gas),	20	"	468	487
Shale,	15	"	483	472
SS., Second sand, blue and shelly,	20	"	503	452
Shale,	87	"	590	365
SS., Third sand, no oil,	5	"	595	+360
Shale, blue, thin streak of red,	750	"	1345	—390
Gritty, shelly, formation, estimated,	25	"	1370	—415
Shale, blue,	1180	"	2550	—1595
" red ("some red shale at 2550'"), say	10	"	2560	—1605
" blue,	155	"	2715	—1760
" black (smell of oil), say	50	"	2765	—1810
" blue, "easy drilling,"	235	"	3000	—2045
" black, "thin" (April, 1887),	15	"	3015	—?060
" and slate (October, 1888),	432	"	3447	—2492
Slate, black, and occasional shells,	233	"	3680	—2725
" brown, muddy (smell of oil),	15	"	3695	—2740
" black.	27	"	3722	—2767
" white,	60	"	3782	—2827
" black, some shells.	50	"	3832	—2877
" white,	18	"	3850	—2895
" brown, muddy,	10	"	3860	—2905
" black, sandy,	10	"	3870	—2915
Limestone, brown, "Corniferous,"	10	"	3880	—2925

Record as currently reported by the drillers during progress of the work in 1886, '87 and '88.

Another record of the findings below 3447 feet is given by Mr. Conway, as follows:

Old record,	3447 to 3447	—2492
Slate and shells,	215 " 3662	—2707
" brown and muddy,	8 " 3670	—2715
" black,	31 " 3701	—2746
" white,	55 " 3756	—2801
" black,	47 " 3803	—2848
" white,	17 " 3820	—2865
" black, muddy,	10 " 3830	—2875
" " hard,	10 " 3840	—2885
Limestone, to bottom,	10 " 3850	—2895

Unproductive.

For some unknown reason the measurements above the black slate have been shortened 30 feet. Probably the well was measured by wire and found to be not so deep as the cable measurements made it. The first version puts the top of the limestone at 2915′ below ocean level, the second at 2885′. On the plot showing the slopes of the Corniferous limestone we use a mean of 2900′

Schuyler & Emery Well.

March, 1886.

Located at Black Ash, Randolph township, Crawford county. Record, per M. W. Quick.

?	687 to 687
Shells,	10 " 697
Slate,	23 " 720
SS., Stray,	23 " 743
Slate,	4 " 747
SS., coarse, pebbly (gas), 10 " white to gray and black, 20	30 " 777

Considerable dark-green oil—said to be 29° gravity. Abandoned.

Emerson Farm Well.

February, 1886.

Located on Emerson farm, Sparta township, Crawford county. Owner and authority, T. J. Vandergrift.

Well mouth above ocean in feet, about		1575
Drive pipe,	111 to 111	1464
?	34 " 145	1430
SS.,	15 " 160	1415
Very soft soapstone (268′ casing),	180 " 340	1235

SS.,	30 to 370	1205
Slate, white,	39 " 409	1166
SS., white, pebble sand,	10 " 419	1156
Slate, dark,	5 " 424	1151
SS., white, coarse, pebble sand,	8 " 432	1143
Slate, dark,	3 " 435	1140
Shale, very hard,	2 " 437	1138
Slate, dark, to bottom,	28 " 465	1110

Unproductive.

Vandergrift Well.

November, 1885.

Located on tract 1633, Sparta township, Crawford county. Owner and authority, T. J. Vandergrift.

Drive pipe,	98 to	98
SS., First sand,	12 "	110
Slate, blue,	88 "	198
SS.,	40 "	238
Slate, blue (252′ of casing),	139 "	377
SS.,	15 "	392
Slate, blue,	158 "	550
Red rock,	45 "	595
Slate, hard,	3 "	598
Slate, blue,	20 "	618
?	82 "	700
Shale, dark gray,	40 "	740
?	35 "	775
Red rock,	5 "	780
Slate, blue,	100 "	880
SS., gray,	25 "	905
Slate, white,	470 "	1375
SS. or sand shale,	5 "	1380
Slate, white,	113 "	1493
" dark, to bottom,	14 "	1507

Unproductive.

Erie Deep Well.

Commenced October, 1887; abandoned January, 1889.

Located in the city of Erie, on Mill Creek, between Fourth and Fifth streets. Owners, Presque Isle Gas Co. Record kept by Prof. G. Guttenberg, of Erie.

Well mouth above ocean in feet, about		600
Conductor,	5 to	5
Shale, light gray,	336 "	341
" darker,	385 "	726
" lighter,	384 "	1110
Limestone,	80 "	1190

Shale, gray,	90 to 1280	
" black, Marcellus,	25 " 1305	
Marl,	20 " 1325	
Limestone, light colored, Corniferous,	75 " 1400	
" gray,	165 " 1565	
" light, coarse,	35 " 1600	
" brown, porous (salt water 1620') Salina,	40 " 1640	
" and iron,	10 " 1650	
" gray,	15 " 1665	
" and shale,	35 " 1700	
Marl,	40 " 1740	
" and gypsum,	10 " 1750	
" brown,	35 " 1785	
" gray,	15 " 1800	
" drab,	15 " 1815	
" and some sand (water ? cased at 1835'),	10 " 1825	
Limestone, first dark and coarse, then lighter and finer; sediment smelling of H_2S at 2175', Niagara,	375 " 2200	
" brownish (salt water with H_2S at 2210'),	30 " 2230	
" hard, fine-grained (recased), Clinton,	100 " 2330	
" drab,	10 " 2340	
Shale, with hard shells,	25 " 2365	
Limestone, yellowish, containing iron,	23 " 2388	
Shales, red, calcarious,	67 " 2455	
SS., light, weathering reddish (little gas in top),	65 " 2520	
Shale, gray, calcarious,	20 " 2540	
" darker, calcarious,	35 " 2575	
" light, hard,	25 " 2600	
" reddish-brown or chocolate, calcarious towards base,	785 " 3385	
" dark-grey, with streaks of lighter color,	637 " 4022	
" dark-gray, nearly black,	108 " 4130	
" lighter and darker alternating,	120 " 4250	
Limestone,	25 " 4275	
Shale, dark-gray, fragments of fossil shells,	35 " 4310	
Limestone, with shale, gray, fossiliferous, 40' / " light and dark, 110' — Trenton,	150 " 4460	

"At 4022' drilling was interrupted two weeks, and on running the bailer when drilling was resumed, some heavy amber-colored oil was taken out. It probably came from some higher level."

After the above record was received from Prof. Guttenberg, specimens of sand pumpings were forwarded by the well owners to Prof. Lesley, State Geologist, who kindly sent me duplicates of them. There are 95 bottles, with the depths from which the samples came marked upon the

corks. The presumption is that the figures marked upon the corks indicate the commencement of the kind of rock contained in the bottle, and that no change of importance occurred until the next specimen was taken. But the bottles are not numbered consecutively. If any have been lost or omitted (and there are some long intervals between specimens) we have no means of discovering it. It is possible, also, that some of the corks may have been changed from one bottle to another, as is quite likely to happen, when all the bottles are alike and unmarked.

The specimens are badly preserved, having been bottled without drying, or allowed to lie exposed to the air and saturated with salt water, until many of them are badly discolored by oxidation. Orange-colored drillings are frequently seen in a suit of specimens, but the true color is almost always white. The application of a magnet will show them to be charged with metal abraided from the drilling tools, and by sifting some, sizable particles can generally be obtained, which, on breaking, disclose the original color of the sand.

Their true character is further disguised by the fact that parts of the well were drilled with hundreds of feet of water in the hole, and other parts (after each casing and before deeper water was struck) were drilled dry. In the dry parts the tools cut rapidly and the sand pumpings are coarse; in the wet parts slow headway was made, the rock was pounded fine, a muddy paste, with salt and sulphury water, came up in the sandpump, it was not thoroughly washed and quickly dried, and hence has more the appearance of marl or of ochery sandstone, as the case may be, than of what it really is—limestone or white sand.

In view of these uncertainties, I feel no confidence in attempting to match the specimens with the record given above (which record was probably made as the drilling progressed, the changes being carefully adjusted from information given directly by the driller when all the facts were fresh), but as a matter of record, appended a list of the bottles as I have numbered them, with a concise description of their contents.

Bottled Specimens from Erie Deep-Well.

January, 1889.

1.	222′	Slate and shale, gray,	
2.	340	Flaggy layers and shale,	
3.	430	Slate, common,	
4.	435	" "	
5.	490	" "	1095 to 1095
6.	540	" "	
7.	725	" nearly black,	
8.	920	" common,	
9.	1005	" "	
10.	1095	Limestone, dove-color, flaky,	
11.	1160	" light-gray, flaky,	100 " 1195
12.	1175	" "	
13.	1195	Slate, common,	105 " 1300
14.	1300	" black, trace of pyrites,	11 " 1311
15.	1311	Limestone, dark-gray fossils,	
16.	1330	" light-gray, slaty,	
17.	1333	" " flaky,	
18.	1335	" " "	
19.	1350?	" little darker,	289 " 1600
20.	1460	" "	
21.	1530	" "	
22.	1540	" light and dark, slaty,	
23.	1565	" nearly white, cherty,	
24.	1600	" buff brown, friable,	20 " 1620
25.	1720	" bluish-gray, "	50 " 1670
26.	1650?	" brown-gray, flaky,	80 " 1750
27.	1700	" "	
28.	1750	" sand and iron,	38 " 1788
29.	1788	" ash-color, flaky,	17 " 1805
30.	1793	" brownish, softer,	
31.	1805	" light slate-color,	
32.	1807	" "	
33.	1820	" "	
34.	1870	" "	
35.	1875	" "	225 " 2030
36.	1900	" "	
37.	1980	" "	
38.	2015	" "	
39.	2030	" white and black, coarse,	5 " 2035
40.	2035	" dove color, flaky,	
41.	2090	" "	
42.	2150	" "	165 " 2200
43.	2170	" "	
44.	2200	" brown-gray, very fine,	
45.	2210	" "	
46.	2240	" "	140 " 2340
47.	2250	" "	
48.	2325	" "	
49.	2340	Slate and limestone,	5 " 2345

50.	2345	Slate, common,	5 to 2350
51.	2350	Sandstone, gray and fine,	5 " 2355
52.	2355	Shale, red and green calcarious,	10 " 2365
53.	2365	SS., white, very fine grained, calcarious,	15 " 2380
54.	2380	Shale, chocolate color,	30 " 2410
55.	2410	SS., yellowish, very fine grained,	115 " 2525
56.	2454	" white, "	
57.	2514	" gray, "	
58.	2520	" yellowish, "	
59.	2525	Slaty shale, reddish-black,	5 " 2530
60.	2530	Slate and shells,	15 " 2545
61.	2545	SS., white, fine grained,	34 " 2579
62.	2575	" "	
63.	2579	Shale, chocolate color,	816 " 3395
64.	2960	" darker with green, calcarious,	
65.	3365	" "	
66.	3370	" lighter, calcarious,	
67.	3385	" chocolate and drab,	
68.	3395	Slaty shale, dark slate color, calcarious,	875 " 4270
69.	3450	" " no calcarious,	
70.	3500	" " "	
71.	3780	" " "	
72.	3990	" " "	
73.	4022	" " "	
74.	4039	" little darker,	
75.	4073	" "	
76.	4130	" "	
77.	4190	" "	
78.	4205	" "	
79.	4250	" "	
80.	4260	" "	
81.	4270	Slate with flakes of limestone,	41 " 4311
82.	4280	" more lime,	
83.	4290	" still more lime,	
84.	4311	Limestone, black and white,	149 " 4460
85.	4320	" "	
86.	4325	" whiter,	
87.	4335	" black and white,	
88.	4338	" "	
89.	4345	" whiter,	
90.	4405	" "	
91.	4415	" "	
92.	4420	" darker,	
93.	4445	" "	
94.	4450	" "	
95.	4460	" "	

Shortening the list by grouping all specimens which have the same general characteristics, and vary only slightly in color and grain, they fall into 28 divisions, as seen below.

1–9.	Slate, ordinary drilling,	1095 to 1095
10–12.	Limestone, grayish, flaky,	100 " 1195
13.	Slate, common,	105 " 1300
14.	Slate, black, pyrites,	11 " 1311
15–23.	Limestone, dark-gray,	289 " 1600
24.	" buff-brown, soft (S. water at 1620'),	20 " 1620
25.	" bluish-gray,	50 " 1670
26–27.	" brown-gray, hard,	80 " 1750
28.	" sand and iron (discolored),	38 " 1788
29–30.	" grayish,	17 " 1805
31–38.	" light slate color (cased at 1835'),	225 " 2030
39.	" white and black, coarse,	5 " 2035
40–43.	" dove-color, hard (mineral water 2210'),	165 " 2200
44–48.	" brown-gray, very fine grained (re-cased),	140 " 2340
49.	Slate and a little limestone,	5 " 2345
50.	" common,	5 " 2350
51.	SS., gray and fine grained,	5 " 2355
52.	Shale, red and green, calcarious,	10 " 2365
53.	SS., white, very fine grained (discolored),	15 " 2380
54.	Shale, chocolate color,	30 " 2410
55–58.	SS., yellowish and white, fine grained,	115 " 2525
59.	Slaty shale, reddish-black,	5 " 2530
60.	Slate and shells,	15 " 2545
61–62.	SS., white, fine-grained,	34 " 2579
63–67.	Shale, chocolate or "red,"	816 " 3395
68–80.	Slaty shale, dark slate color,	875 " 4270
81–83.	Slate and flakes of gray limestone,	41 " 4311
84–95.	Limestone, black and white,	149 " 4460

Chapter XIV.

New Well Records in Butler County.

Sarver's Well (No. 121).

May 26, 1888.

No. 1, on Friendley farm, Sarver's Station, Buffalo township, Butler county. Owners and authority, Philadelphia Gas Company.

Specimen numbers.			
1.	Gravel,	20 to	20
2.	Slate, dark, sandy,	65 "	85
3.	SS., white,	55 "	140
4.	Slate and shells,	15 "	155
5.	Coal,	5 "	160
6.	Slate, dark,	20 "	180
7.	Sand in shells, dark,	45 "	225
8.	SS., gray, some slate,	15 "	240
9.	Slate and shells, dark,	22 "	262
10.	Lime, gray "Ferriferous,"	20 "	282
11.	SS., gray, slaty, micaceous,	35 "	317
12.	SS., white,	65 "	382
13.	Slate, black,	8 "	390
14.	Coal,	5 "	395
15.	Slate, black sandy,	90 "	485
16.	SS., white,	75 "	560
17.	Slate, black,	40 "	600
18.	SS., gray, slaty,	50 "	650
19.	" white,	150 "	800
20.	Slate, gritty,	50 "	850
21.	SS., white,	50 "	900
22.	Slate, gritty, blue,	10 "	910
23.	SS., white,	10 "	920
24.	" gray,	40 "	960
25.	Slate, dark (little gas),	210 "	1170
26.	SS., gray, Gas sand,	5 "	1175
27.	Sandy slate,	7 "	1182
28.	Sand and shells, gray,	58 "	1240
29.	Sandy slate and pebbles,	5 "	1245
30.	Slate and shells, dark,	75 "	1320

31. SS., gray, fine-grained,	25 to	1345
32. Slate and shells, dark,	40 "	1385
33. SS., yellow pebbles and red clay,	5 "	1390
34. SS., greenish-gray, and slate,	40 "	1430
35. " and reddish slate,	10 "	1440
36. Slate and shells, dark,	25 "	1465
37. SS., gray, flaky,	10 "	1475
38. Sandy slate, red and gray,	10 "	1485
39. SS., brown and gray, fine-grained,	5 "	1490
40. Slate and shells, dark,	40 "	1530
41. Sandy slate, brownish,	10 "	1540
42. SS., gray, some pebbles, slaty,	25 "	1565
43. " white,	110 "	1675
44. " gray pebbly and slaty,	5 "	1680
45. " white, oil and gas sand,	30 "	1710
46. Slate and shells, dark,	300 "	2010
" dark,	200 "	2210
" and shells, gray,	150 "	2360
" " dark,	200 "	2560
" dark,	495 "	3055

Abandoned.

Fry Farm Well No. 1.

1886.

Located on Fry farm, Sarver station, Butler county. Owners and authority, Fisher Oil Co. Contractor, A. K. Klingensmith.

?	658 to	658
Limestone,	40 "	698
?	98 "	796
SS., Mountain sand,	225 "	1021
?	25 "	1046
SS., First sand,	119 "	1165
?	200 "	1365
SS., Gas sand,	32 "	1397
?	111 "	1508
SS., Hundred foot (gas at 1515'),	124 "	1532
?	112 "	1644
SS., Thirty foot,	59 "	1703
?	22 "	1725
SS., Blue Monday and Boulder run together,	72 "	1797
?	25 "	1822
SS., Third sand,	46 "	1868
?	24 "	1892
SS., Fourth sand,	28 "	1920
? to bottom,	10 "	1930

Dickey Farm No. 1.

Located at Reibold, Forward township, Butler county.

Owners and authority, Fisher Oil Co. White & Phipps, contractor.

?	460 to	460
Limestone,	15 "	475
?	745 "	1220
SS., Gas sand,	100 "	1320
?	30 "	1350
SS., Hundred foot,	100 "	1450
?	50 "	1500
SS., Thirty foot,	22 "	1522
?	141 "	1663
SS., Third sand,	43 "	1706
? to bottom,	1 "	1707

Jno. Dickey Farm No. 2.

Located at Reibold, Forward township, Butler county. Owners and authority, Fisher Oil Co. S. W. Phipps, contractor.

?	460 to	460
Limestone,	5 "	465
?	235 "	700
SS., Mountain sand,	200 "	900
?	200 "	1100
SS., First sand,	100 "	1200
" Gas sand (salt water 1250'),	100 "	1300
?	66 "	1366
SS., Hundred foot (1461' casing),	96 "	1462
?	54 "	1516
SS., Thirty foot,	20 "	1536
?	30 "	1566
SS., Blue Monday,	15 "	1581
?	39 "	1620
SS., Boulder,	10 "	1630
?	30 "	1660
SS., Third sand,	46 "	1706
? to bottom,	5 "	1711

Eichenlaub Farm Well.

July, 1885.

Located at Herman Station, Summit township, Butler county. Owners and authority, Fisher Oil Co.

?	700 to	700
SS., Mountain sand,	330 "	1030
?	420 "	1450
SS., Hundred foot (salt water 1457'),	105 "	1555
?	80 "	1635

SS., Thirty foot,	40 to	1675
SS., Blue Monday,	25 "	1700
?	10 "	1710
SS., Boulder,	35 "	1745
?	24 "	1769
SS., Third sand,	30 "	1799
Slate,	20 "	1819
SS., Fourth sand,	15 "	1834
? to bottom,	67 "	1901

John Smith Farm Well.

July, 1886.

Located at Herman Station, Summit township, Butler county. Owners and authority, Fisher Oil Co.

? "no limestone" (585′ of $5\frac{5}{8}$′ casing),	700 to	700
SS., Mountain sand,	225 "	925
?	225 "	1150
SS., First sand,	25 "	1175
?	175 "	1350
SS., Gas sand,	40 "	1390
?	38 "	1428
SS., Hundred foot (salt water 1473′),	112 "	1540
?	25 "	1565
SS., Thirty foot,	45 "	1610
?	30 "	1640
SS., Blue Monday,	26 "	1666
? (Boulder not mentioned),	21 "	1687
SS., Third sand,	26 "	1713
?	37 "	1750
SS., Fourth sand (heavy gas in top),	34 "	1784

Marks Well.

Near Herman Station, Summit township, Butler county. Owners and authority, Fisher Oil Co. Contractor, F. W. Leidecker.

? (620′ casing),	700 to	700
SS., Mountain sand,	300 "	1000
?	190 "	1190
SS., First sand,	25 "	1215
?	155 "	1370
SS., Gas sand (salt water 1390′),	35 "	1405
?	90 "	1495
SS., Hundred foot,	110 "	1605
?	25 "	1630
SS., Thirty foot,	35 "	1665
?	35 "	1700
SS., Blue Monday,	33 "	1733
?	12 "	1745

SS., Boulder,	12 to	1757
?	47 "	1804
SS., Fourth sand,	27 "	1831
? to bottom,	13 "	1844

Reott Farm Well.

April 2, 1886.

On Reatt farm, near Humes Station, Summit township, Butler county. Owners and authority, Fisher Oil Co. A. K. Klingensmith, contractor.

?	443 to	443
Lime,	25 "	468
? (573′ casing),	242 "	710
SS., Mountain sand,	210 "	920
?	35 "	955
SS., First sand,	115 "	1070
?	180 "	1250
SS., Gas sand,	30 "	1280
?	148 "	1428
SS., Hundred foot,	107 "	1535
?	22 "	1557
SS., Thirty foot,	33 "	1590
?	2 "	1592
SS., Blue Monday,	22 "	1614
?	40 "	1654
SS., "Boulder,"	18 "	1672
?	8 "	1680
SS., Third sand (oil at 1688′),	53 "	1733
?	26 "	1759
SS., Fourth sand,	20 "	1779
? to bottom,	42 "	1821

Unproductive.

Thompson Farm Well.

December 20, 1885.

On Thompson farm, Mahan district, Middlesex township, Butler county. Owners and authority, Fisher Oil Co. A. K. Klingensmith, contractor.

? (696′ of $5\frac{5}{8}$′ casing),	746 to	746
SS., Mountain sand,	219 "	965
?	67 "	1032
SS., First sand,	125 "	1157
?	189 "	1346
SS., Gas sand (salt water at 1357′),	64 "	1410
?	62 "	1472
SS., Hundred foot (1500′ of $4\frac{1}{4}$″ casing),	125 "	1597
?	13 "	1610

SS., Thirty foot,	63 to	1673
?	23 "	1696
SS., Blue Monday,	33 "	1729
?	9 "	1738
SS., Boulder,	31 "	1769
?	28 "	1797
SS., Third sand,	23 "	1820
?	26 "	1846
SS., Fourth sand,	12 "	1858
? to bottom,	4 "	1862

Craig & Cappeau Well.

1886 ?

Located on the Chandler farm, Middlesex township, Butler county. Authority, the company's books.

? (cased 678'),	1293 to	1293
SS., Gas sand (salt water at 1305'),	100 "	1393
?	47 "	1440
SS., Hundred foot,	130 "	1570
?	5 "	1575
SS., Thirty foot,	65 "	1640
?	30 "	1670
SS., Blue Monday (oil show at 1680'),	25 "	1695
?	23 "	1718
SS., Boulder,	29 "	1747
?	30 "	1777
SS., hard, white, Third sand,	10 "	1787
?	33 "	1820
SS., Fourth sand,	10 "	1830
? to bottom,	10 "	1840

Coyle Farm No. 1.

March, 1887.

Located in Donegal township, Butler county. Owners and authority, Fisher Oil Co. Younkins & Co., contractors.

?	335 to	335
Limestone,	24 "	359
? (cased 555'),	236 "	595
SS., Mountain sand,	200 "	795
?	115 "	910
SS., First sand,	50 "	960
?	200 "	1160
SS., Gas sand,	65 "	1225
?	80 "	1305
SS., Hundred foot,	50 "	1355
?	20 "	1375
SS., Thirty foot,	25 "	1400
?	40 "	1440

SS., Blue Monday,	10 to 1450
?	15 " 1465
SS., Boulder,	10 " 1475
?	87 " 1562
SS., Third sand, to bottom,	52 " 1614

McCrea Farm No. 1.

April, 1887.

Located in Donegal township, Butler county. Owners and authority, Fisher Oil Co. A. K. Klingensmith, contractor.

?	330 to 330
Limestone,	29 " 359
? (cased at 540'),	226 " 585
SS., Mountain sand,	215 " 800
?	120 " 920
SS., First sand,	40 " 960
?	200 " 1160
SS., Gas sand (no water),	45 " 1205
?	75 " 1280
SS., Hundred foot,	90 " 1370
?	32 " 1402
SS., Thirty foot,	35 " 1437
?	13 " 1450
SS., Boulder,	40 " 1490
?	53 " 1543
SS., Third sand, to bottom,	54½ " 1597½

Hickey Farm Wells.

Records of wells Nos. 3, 4, 5, 6, 7, 8, 9 and 12, located on the Hickey farm, in the southerly part of Donegal township, Butler county. Owners, Fisher Oil Co. Authority, the company's books.

Hickey Farm No. 3.

November 29, 1886.

Contractors, Younkins & Co.

?	330 to 330
Limestone,	22 " 352
? (560' of casing),	218 " 570
SS., Mountain sand,	200 " 770
?	130 " 900
SS., First sand,	50 " 950
?	170 " 1120
SS., Gas sand,	50 " 1170
?	145 " 1315

SS., Hundred foot,	50	to	1365
?	15	"	1380
SS., Thirty foot,	20	"	1400
?	50	"	1450
SS., Blue Monday,	15	"	1465
?	15	"	1480
SS., Boulder,	15	"	1495
?	75	"	1570
SS., Third sand, to bottom,	39	"	1609

Hickey Farm No. 4.

1886.

Contractors, Younkins & Co.

?	312	to	312
Limestone,	20	"	332
? (cased 569'),	243	"	575
SS., Mountain sand,	200	"	775
?	103	"	878
SS., First sand,	50	"	928
?	172	"	1100
SS., Gas sand,	50	"	1150
?	145	"	1295
SS., Hundred foot,	50	"	1345
?	15	"	1360
SS., Thirty foot,	25	"	1385
?	40	"	1425
SS., Blue Monday,	15	"	1440
?	20	"	1460
SS., Boulder,	15	"	1475
?	65	"	1540
SS., Third sand,	$72\frac{1}{2}$	"	$1612\frac{1}{2}$

Hickey Farm No. 5.

1886.

Contractor, A. K. Klingensmith.

?	290	to	290
Limestone,	25	"	315
? (cased 520'),	275	"	590
SS., Mountain sand,	210	"	800
?	40	"	840
SS., First sand,	100	"	940
?	160	"	1100
SS., Gas sand (little salt water),	40	"	1140
?	117	"	1257
SS., Hundred foot,	97	"	1354
?	26	"	1380
SS., Thirty foot,	30	"	1410
?	38	"	1448
SS., Blue Monday,	44	"	1492

?	29 to 1521
SS., Third sand,	62 " 1583
? some shells,	62 " 1645

Hickey Farm No. 6.

December, 1886.

Younkins & Co., contractors.

?	370 to 370
Limestone,	20 " 390
? (cased 600′),	225 " 615
SS., Mountain sand,	200 " 815
?	125 " 940
SS., First sand,	50 " 990
?	170 " 1160
SS., Gas sand,	50 " 1210
?	145 " 1355
SS., Hundred foot,	50 " 1405
?	15 " 1420
SS., Thirty foot,	30 " 1450
?	40 " 1490
SS., Blue Monday,	15 " 1505
?	15 " 1520
SS., Boulder,	15 " 1535
?	73 " 1608
SS., Third sand, to bottom,	52 " 1660

Hickey Farm No. 7.

January, 1887.

A. K. Klingensmith, contractor.

?	360 to 360
Limestone,	20 " 380
? (612′ casing),	280 " 660
SS., Mountain sand,	215 " 875
?	35 " 910
SS., First sand,	90 " 1000
?	192 " 1192
SS., Gas sand (no water),	25 " 1217
?	111 " 1328
SS., Hundred foot,	90 " 1418
?	32 " 1450
SS., Thirty foot,	30 " 1480
?	38 " 1518
SS., Boulder,	32 " 1550
?	44 " 1594
SS., Third sand (oil 1603½′),	33 " 1627

Wm. Hickey Farm No. 8.

February, 1887.

A. K. Klingensmith, contractor.

?	382	to	382
Limestone,	22	"	404
? (cased 635′),	271	"	675
SS., Mountain sand,	215	"	890
?	37	"	927
SS., First sand,	90	"	1017
?	198	"	1215
SS., Gas sand,	25	"	1240
?	102	"	1342
SS., Hundred foot,	95	"	1437
?	33	"	1470
SS., Thirty foot,	30	"	1500
?	30	"	1530
SS., Blue Monday,	35	"	1565
?	44	"	1609
SS., Third sand (oil at 1624′),	35	"	1644

Hickey Farm No. 9.

January, 1887.

Younkins & Co., contractors.

?	385	to	385
Limestone,	24	"	409
? (cased 620′),	211	"	620
SS., Mountain sand,	200	"	820
?	130	"	950
SS., First sand,	50	"	1000
?	180	"	1180
SS., Gas sand,	55	"	1235
?	135	"	1370
SS., Hundred foot,	50	"	1420
?	15	"	1435
SS., Thirty foot,	25	"	1460
?	45	"	1505
SS., Blue Monday,	12	"	1517
?	18	"	1535
SS., Boulder,	15	"	1550
?	60	"	1610
SS., Third sand, to bottom,	69	"	1679

Hickey Farm No. 12.

1887.

?	420	to	420
Limestone,	20	"	440
? (cased 616′),	230	"	670

SS., Mountain sand, estimated,	150	to	820
?	400	"	1220
Salt water at			1220
?	130	"	1350
SS., Hundred foot,	95	"	1445
?	234	"	1679
SS., Fourth sand,	51	"	1730
?	10	"	1740

Wallace Farm Wells.

Records of wells Nos. 16, 17, 18 and 21, on the Wallace farm, Thorn Creek district, Penn township, Butler county. Owners and authority, Fisher Oil Co. Contractors, Mase & Murphy.

Wallace Farm No. 16.

January 11, 1885.

?	455	to	455
Limestone,	20	"	475
? (680′ casing),	225	"	700
SS., Mountain sand,	210	"	910
?	368	"	1278
SS., Gas sand,	40	"	1318
?	98	"	1416
SS., Hundred foot,	90	"	1506
?	74	"	1580
SS., Thirty foot,	28	"	1608
?	22	"	1630
SS., Blue Monday,	20	"	1650
?	50	"	1700
SS., Boulder,	5	"	1705
?	17	"	1722
SS., Third sand,	30	"	1752
SS., Fourth sand,	16	"	1768
? to bottom,	4	"	1772

Wallace Farm No. 17.

1885.

?	484	to	484
Limestone,	25	"	509
?	216	"	725
SS., Mountain sand,	290	"	1015
?	410	"	1425
SS., Hundred foot,	109	"	1534
?	35	"	1569
SS., Thirty foot,	35	"	1604
?	29	"	1633
SS., Blue Monday,	30	"	1663
?	12	"	1675

SS., Boulder,	15 to	1690
?	46 "	1736
SS., Third sand,	49 "	1785

Wallace Farm No. 18.

March 10, 1885.

?	400 to	400
Limestone,	28 "	428
? (600′ casing),	187 "	615
SS., Mountain sand,	260 "	875
?	325 "	1200
SS., Gas sand (salt water 1224′),	50 "	1250
?	100 "	1350
SS., Hundred foot,	110 "	1460
?	50 "	1510
SS., Thirty foot,	38 "	1548
?	22 "	1570
SS., Blue Monday,	28 "	1598
?	22 "	1620
SS., Boulder,	5 "	1625
?	25 "	1650
SS., Third sand,	51 "	1701
? to bottom,	17 "	1718

Wallace Farm No. 21.

September 21, 1885.

Conductor,	28 to	28
?	412 "	440
Lime,	25 "	465
? (cased 650′),	235 "	700
SS., Mountain sand,	200 "	900
?	130 "	1030
SS., First sand,	60 "	1090
?	170 "	1260
SS., Gas sand,	40 "	1300
?	90 "	1390
SS., Hundred foot,	90 "	1480
?	80 "	1560
SS., Thirty foot,	35 "	1595
?	35 "	1630
SS., Blue Monday,	20 "	1650
?	15 "	1665
SS., Boulder,	20 "	1685
?	13 "	1698
SS., Third sand,	43 "	1741
? to bottom,	6 "	1747

Marshall Farm Wells.

Records of wells Nos. 3, 4, 5, 10, 11, 14, 17 and 19, Mar-

shall farm, Thorn Creek district, Penn township, Butler county. Owners, Fisher Oil Co. Authority, the company's books.

Marshall Farm No. 3.

1884.

Contractor, Aaron Leidecker.

?	410 to	410
Limestone,	10 "	420
?	95 "	515
SS., Mountain sand,	215 "	730
?	160 "	890
SS., First sand,	95 "	985
?	205 "	1190
SS., Gas sand, thickness not given, at		1190
? (salt water at 1210′),	169 "	1359
SS., Hundred foot,	100 "	1459
?	191 "	1650
SS., Fourth sand,	47 "	1697
Slate, to bottom,	3 "	1700

Marshall Farm No. 4.

January 13, 1885.

Contractors, Kennedy & Fry.

?	200 to	200
Limestone,	20 "	220
? ("struck Mountain sand at 462′"),	530 "	750
SS., First sand, thickness not given, struck at		750
?	270 "	1020
SS., Gas sand (salt water 1040′).	20 "	1040
?	115 "	1155
SS., Hundred foot,	95 "	1250
?	70 "	1320
SS., Thirty foot,	25 "	1345
?	20 "	1365
SS., Blue Monday,	25 "	1390
?	25 "	1415
SS., Boulder,	20 "	1435
?	43 "	1478
SS., Fourth sand,	47 "	1525
Slate to bottom,	3 "	1528

Marshall Farm No. 5.

1885.

Contractor, F. W. Leidecker.

?	330 to	330
Limestone,	30 "	360
? (505′ of casing),	515 "	875

SS., First sand,	30	to	905
? (salt water at 1150'),	379	"	1284
SS., Hundred foot,	100	"	1384
?	50	"	1434
SS., Thirty foot,	25	"	1459
? (18' Blue Monday, depth not given),	61	"	1520
SS., Boulder,	20	"	1540
?	40	"	1580
SS., Fourth sand,	56	"	1636
Slate,	4	"	1640

Marshall Farm No. 10.

1885.

Contractor, Doc. Coe.

?	225	to	225
Limestone,	22	"	247
?	285	"	532
SS., Mountain sand,	120	"	652
?	163	"	815
SS., First sand,	30	"	845
?	225	"	1070
SS., Gas sand (salt water at 1083'),	60	"	1130
? (1130' of casing),	50	"	1180
SS., Hundred foot,	100	"	1280
?	45	"	1325
SS., Thirty foot,	30	"	1355
? (20' Blue Monday, depth not given),	105	"	1460
SS., Boulder,	30	"	1490
?	24	"	1514
SS., Fourth sand,	38	"	1552
? to bottom,	17	"	1569

Marshall Farm No. 11.

1885.

Contractors, Kennedy & Fry.

?	190	to	190
Limestone,	20	"	210
?	348	"	558
SS., Mountain sand, thickness not given, at			558
?	226	"	784
SS., First sand,	50	"	834
?	201	"	1035
SS., Gas sand, thickness not given, at			1035
? (salt water at 1040', 1109' casing),	157	"	1192
SS., Hundred foot,	100	"	1292
?	40	"	1332
SS., Thirty foot,	30	"	1362
?	50	"	1412

SS., Blue Monday,	25	to	1437
?	16	"	1453
SS., Boulder,	22	"	1475
?	13	"	1488
SS., Fourth sand,	38	"	1526
? to bottom,	$17\frac{1}{2}$	"	$1543\frac{1}{2}$

Marshall Farm No. 14.

March 3, 1886.

Contractor, F. W. Leidecker.

?	324	to	324
Limestone (340′ casing),	25	"	349
?	276	"	625
SS., Mountain sand,	150	"	775
?	45	"	820
SS., First sand,	30	"	850
?	280	"	1130
SS., Gas sand (salt water 1145′),	55	"	1185
?	89	"	1274
SS., Hundred foot,	104	"	1378
? (25′ of "Thirty foot," depth not given),	197	"	1575
SS., Fourth sand,	52	"	1627
?	$17\frac{1}{2}$	"	$1644\frac{1}{2}$

Marshall Farm No. 17.

1886.

Contractors, Page & Co.

?	210	to	210
Limestone,	20	"	230
?	210	"	440
SS., Mountain sand, thickness not given, at			440
? ("SS. from 510 to 550′," cased at 448′),	605	"	1045
SS., Gas sand (salt water at 1050′),	40	"	1085
?	105	"	1190
SS., Hundred foot,	95	"	1285
?	65	"	1350
SS., Thirty foot,	28	"	1378
?	20	"	1398
SS., Blue Monday,	20	"	1418
?	64	"	1482
SS., Fourth sand,	43	"	1525
? to bottom,	15	"	1540

Marshall Farm No. 19.

1886.

Contractor, Doc. Coe.

?	194	to	194
Limestone,	18	"	212
? (374′ of $5\frac{5}{8}$″ casing),	303	"	515

SS., Mountain sand, thickness not given, at		515
?	275 to	790
SS., First sand,	45 "	835
?	205 "	1040
SS., Gas sand (salt water 1048'),	15 "	1055
?	125 "	1180
SS., Hundred foot (1274' of $4\frac{1}{4}$'' casing),	95 "	1275
?	63 "	1338
SS., Thirty foot,	14 "	1352
?	63 "	1415
SS., Blue Monday,	20 "	1435
?	68 "	1503
SS., Fourth sand,	30 "	1533
?	8 "	1541

Records of 8 Wells in Butler county, Owned by Messrs. Phillips Bros. Authority, J. A. Bonner, Supt.

Stamm No. 5.

1885.

Located on Stamm farm, Glade run, Forward township.

?	1092 to	1092
SS., Gas sand,	100 "	1192
?	56 "	1248
SS., Hundred foot,	120 "	1368
?	185 "	1553
SS., Third sand, to bottom,	50 "	1603

Beam Farm No. 4.

1887.

Also at Glade run.

?	1222 to	1222
SS., Gas sand,	100 "	1322
?	35 "	1357
SS., Hundred foot,	120 "	1477
?	180 "	1657
SS., Third or Fourth, not through, oil 15' in,	26 "	1683

Slater No. 3.

1887.

Also at Glade run.

?	1213 to	1213
SS., Hundred foot,	97 "	1310
?	203 "	1513
SS., Third, not through, oil 30' in,	40 "	1553

Mechlin Farm No. 1.

Located 4 miles south of Butler.

?	1364 to 1364
SS., Hundred foot,	115 " 1479
?	168 " 1647
SS., Third sand,	25 " 1672
?	18 " 1690
SS., Fourth sand,	28 " 1718

Shraeder Well.

1886.

Located 5 miles south of Butler.

?	397 to 397
Limestone,	7 " 404
?	996 " 1400
SS., Hundred foot,	100 " 1500
?	217 " 1717
SS., Fourth sand,	15 " 1732

Emerick Farm Well.

1887.

Located 4 miles southeast of Butler.

?	1409 to 1409
SS., Hundred foot,	112 " 1521
?	149 " 1670
SS., Third sand,	24 " 1694
?	38 " 1732
SS., Fourth sand,	15 " 1747

Johnson Farm Well.

1886.

Located 4 miles southeast of Butler.

?	523 to 523
Limestone,	10 " 533
?	930 " 1463
SS., Hundred foot,	108 " 1571
?	150 " 1721
SS., Third sand,	22 " 1743
?	37 " 1780
SS., Fourth sand,	15 " 1795

Will Farm Well.

1886.

Located 10 miles east of Butler.

?	212 to 212
Limestone,	10 " 222
?	1018 " 1240

SS., Hundred foot,	80 to 1320
?	158 " 1478
SS., Third sand,	23 " 1501
?	54 " 1555
SS., Fourth sand,	35 " 1590

Boyd Well.

October, 1888.

Located on the Basecnecker farm, near Mars station, Adams township, Butler county. Authority, S. M. Boyd.

Well mouth 20′ above R. R. station.

?	1273 to 1273
SS., Gas sand,	125 " 1398
Slate,	8 " 1406
SS., Hundred foot (oil at 1433′, salt water 1436′, cased at 1460′, little oil at 1461′),	142 " 1548
Slate and shells, no sandstone,	202 " 1750
SS., Third sand,	7 " 1757
Slate, to bottom,	143 " 1900

Unproductive.

Frazer Well No. 1.

March, 1887.

Located on the Frazer farm, Butler county. Authority, J. Overy, driller.

?	330 to 330
Limestone,	18 " 348
?	986 " 1334
SS., Second sand, say	30 " 1364
?	98 " 1462
SS., Gas sand and boulder,	18 " 1480
?	8 " 1488
SS., salt water sand, say	20 " 1508
?	45 " 1553
SS., gray, say	17 " 1570
?	26 " 1596
SS., Third sand,	29 " 1625
?	39 " 1664
SS., Fourth sand (gas at 1655′),	18 " 1682
?	34 " 1716

Chapter XV.

New Well Records in Westmoreland County.

Fulton Well, (No. 98.)

January 15, 1887.

No. 1, on Fulton farm, Appolo district, Allegheny township, Westmoreland county. Owners and authority, Philadelphia Gas Co.

Conductor,	15 to	15
SS., gray,	25 "	40
Shale and SS., red and white,	8 "	48
SS., pebbles, white,	52 "	100
Shale, sandy, brown and red,	25 "	125
SS., white,	125 "	250
" gray,	150 "	400
" white,	120 "	520
Shale, dark,	50 "	570
SS., white,	50 "	620
Shale, dark,	40 "	660
SS., white and gray, pebbles,	140 "	800
Shale and sandstone,	50 "	850
Shale, dark,	20 "	870
SS., gray,	80 "	950
SS., white, with red and gray,	156 "	1106
Sandy shale, dark,	94 "	1200
SS., shaly, gray,	40 "	1240
" and slate,	60 "	1300
Shale, sandy, brown,	100 "	1400
" " gray,	30 "	1430
" with SS.,	45 "	1475
Slate and SS., white,	25 "	1500
SS., white, fine, pebbly (gas at top),	125 "	1625
Pebble shells (gas),	25 "	1650
Slate and sand, sandy and slaty,	115 "	1765
?	90 "	1855

Duff Well (No. 113.)

June 25, 1887.

No. 1, on Jno. Duff farm, Appolo district, Allegheny

township, Westmoreland county. Owners and authority, Philadelphia Gas Co.

Conductor,	20	to	20
Slate,	50	"	70
Limestone,	50	"	120
Coal,	1	"	121
Slate, white,	69	"	190
SS., gray,	60	"	250
Slate, blue,	25	"	275
SS., gray,	40	"	315
" white,	135	"	450
" gray,	80	"	530
Shells, white,	50	"	580
SS., gray,	15	"	595
Slate, red,	25	"	620
SS., white,	180	"	800
Slate and shells,	75	"	875
SS., gray,	60	"	935
" white,	40	"	975
Slate and shells,	50	"	1025
SS., white,	75	"	1100
Slate, white,	50	"	1150
SS., gray,	50	"	1200
Slate and shells,	150	"	1350
SS., white,	30	"	1380
Slate and shells, black,	20	"	1400
SS., white,	75	"	1475
" gray,	75	"	1550
" white (gas),	10	"	1560
" gray,	65	"	1625
Slate and shells, white,	75	"	1700
SS., red,	100	"	1800
Slate and shells, red,	100	"	1900
SS., red,	50	"	1950
Slate, red,	50	"	2000
" white,	200	"	2200
SS., gray,	50	"	2250
Slate, white,	50	"	2300
SS., white,	20	"	2320
Slate, white,	80	"	2400
?	487	"	2847

Unproductive.

Pine Run Gas Co., Well No 1.

November, 1888.

Located on the Weister farm on Pine Run, in Upper Burrell township, Westmoreland County. About $1\frac{3}{4}$ miles S. W. of the Martin farm well. Authority, E. M. Hukill.

?	1550 to	1550
SS., Murrysville gas sand, say	30 "	1580
?	130 "	1710
Pine Run gas sand, say	20 "	1730
?	110 "	1840
Red rock, mostly,	260 "	2100
Slate and shells,	50 "	2150
SS., top coarse and some gas, bottom fine,	40 "	2190
Slate, mostly,	110 "	2300
SS., little gas,	10 "	2310
Slate, mostly, to bottom,	190 "	2500

Sproul Well.

1887.

On E. Sproul farm, Allegheny township, Westmoreland county; one mile N. W. of Shearer's cross roads and on little stream flowing north to Kiskiminetis river. Authority, Wm. A. Earseman.

?	215 to	215
Coal, etc.,	9 "	224
Limestone,	6 "	230
SS., gray, 65, " white, 100,	165 "	395
Slate,	35 "	430
SS., gray, . . 25 " red, . . . 20 " gray, . . 25 " white, . . 50	120 "	550
Slate,	50 "	600
Coal,	7 "	607
Slate,	40 "	647
SS., gray,	50 "	697
Slate (cased here,)	3 "	700
SS., white; "70 foot rock,"	125 "	825
Slate and shells,	30 "	855
SS., white, . . . 100 " black, . . . 45 " white, . . . 20 " gray, . . . 30 " clover seed, 50 " gray, dark, 40 — "Mountain, SS," "Big Injun,"	285 "	1140
SS., gray, fine, 15 " green, . . 25	40 "	1180
Slate and sand,	50 "	1230
SS., gray,	35 "	1265
Slate and shells,	30 "	1295
SS., white, pebbly (gas),	15 "	1310
Slate and shells,	35 "	1345
Slate,	75 "	1420

SS., blaek, . . 10 " gray, . . 15		25 to 1445
Slate,		80 " 1525
SS., clover seed, . . . 10 " white and pebbles, 20	"Gantz" (gas), . . .	30 " 1555
Slate and shells,		40 " 1595
SS., white (water), . . 30 " gray, fine, soft, . . 20 " white pebble (oil), 15	Oil 1645′ to 1660′ amber,	65 " 1660
Slate, some red,		152 " 1812
SS., gray, "Gordon,"		8 " 1820
Red rock, say		20 " 1840

Unproductive.

Wm. Metcalf Well.

July 26, 1887.

Located about 70 feet above mouth of Sproul well, Allegheny township, Westmoreland County. Authority, T. J. Vandergrift.

Clay,	5 to	5
Red rock and Crinoidal limestone,	10 "	15
Shale,	20 "	35
Slate, blaek,	9 "	44
Hard shell,	5 "	49
Slate, white,	26 "	75
Hard shell (water at 75′),	5 "	80
Slate, black,	50 "	130
SS., gray,	70 "	200
Slate, white,	20 "	220
SS., white,	15 "	235
Slate, white,	17 "	252
SS, white, hard,	43 "	295
Coal,	5 "	300
Limestone,	5 "	305
SS., gray,	75 "	380
Slate, white,	28 "	408
SS., hard,	80 "	488
Slate, white,	17 "	505
SS., hard, gray,	75 "	580
Slate, white,	15 "	595
Coal,	6 "	601
Slate, black,	20 "	621
SS., hard, white (salt water at 686′,)	70 "	691
Coal,	2 "	693
Slate, blaek,	17 "	710
Slate,	60 "	770
Red rock,	20 "	790
Limestone,	23 "	813
SS., hard, white,	100 "	913
" " red,	20 "	933
" " white,	50 "	983

Slate, black,	25 to	1008
SS., green,	20 "	1028
" hard, white,	240 "	1268
Red rock,	15 "	1283
SS., hard, white,	109 "	1392
Slate and shells,	203 "	1595
SS., Gas sand, drilled in it,	5 "	1600

September 14, 1887, rock pressure over 500 pounds ; velocity 1636′ per minute, through $5\frac{5}{8}$″ casing.

Murrysville Wells.

Records of wells Nos. 18, 20, 30, 44, 46 and 49, located in the Murrysville gas district, Franklin township, Westmoreland county. Owners and authority, Philadelphia Gas Co.

King Well (No. 18) Aug. 1885.

No. 2, on King Farm, Murrysville.

Rock,	22 to	22
Sand,	50 "	72
Coal,	2 "	74
SS.,	12 "	86
Slate and shells,	100 "	186
SS.,	20 "	206
Slate and shells,	144 "	350
SS., "Eighty foot,"	50 "	400
Slate,	20 "	420
SS., "Hundred foot,"	92 "	512
Red rock and slate,	83 "	595
SS., "One hundred and forty foot,"	105 "	700
Slates,	90 "	790
Sand, "Two hundred foot,"	233 "	1023
Slate,	12 "	1035
SS.,	75 "	1110
Slate and shells,	100 "	1210
SS., "Thirty foot,"	34 "	1244
Slate,	76 "	1320
SS. (gas at 1325′),	17 "	1337

King Well (No. 20).

April 1, 1886.

No. 3, on King farm, Murrysville.

Clay and gravel,	20 to	20
SS.,	150 "	70
Slate,	150 "	220
SS., black,	80 "	300
Slate,	50 "	350

SS., white, "Eighty foot,"	80 to	430
Slate,	35 "	465
SS., white, "One hundred and forty foot,"	145 "	610
Slate,	70 "	680
SS., white, "Two hundred foot,"	200 "	880
Slates,	30 "	910
SS., black,	110 "	1020
Slate,	80 "	1100
SS., white,	30 "	1130
Slate and shells,	197 "	1227
Slate and shells,	9 "	1336
SS.,	4 "	1340
Drilled in sand,	24 "	1364

Verner Well (No. 30).

May, 1884.

No. 1, on Verner farm, Murrysville.

Slate and sand,	160 to	160
Coal,	1 "	161
Slate and sand,	109 "	270
Coal,	8 "	278
Slate and sand,	162 "	440
SS., blue (water),	90 "	530
Slate, dark,	37 "	567
" red,	6 "	573
SS., yellow (water),	32 "	605
Slate, black, gritty,	5 "	610
SS., yellow, close,	38 "	648
Slate,	15 "	663
" sandy,	47 "	710
SS., white,	250 "	960
Slate,	5 "	965
SS., light-blue,	35 "	1000
" dark-blue,	130 "	1130
Slate, very red,	20 "	1150
" shelly,	135 "	1285
SS., dark,	27 "	1312
Slate, black, very soft,	3 "	1315
SS., fine, light colored,	22 "	1337
Slate,	73 "	1410
Gas sand, drilled in it,	30 "	1440

Miller Well (No. 44).

December, 1886.

No. 1, on Miller farm, Murrysville.

Surface,	20 to	20
SS., brown,	30 "	50
Slate, soft,	25 "	75
Limestone, black, hard,	8 "	83

Slate, soft, black,	10 to	93
SS., gray, hard,	7 "	100
" "	20 "	120
Coal seam,	12 "	132
Slate, white, soft,	88 "	220
" black,	35 "	255
SS., gray, hard,	8 "	263
Slate, black, soft,	15 "	278
SS., gray, hard,	60 "	338
Slate, black, hard,	4 "	342
Limestone, hard, black,	5 "	347
Slate, black, soft,	68 "	415
SS., black, hard,	100 "	515
Slate, black, soft,	45 "	560
SS., gray, hard,	27 "	587
" red, soft,	41 "	628
Lime, hard,	30 "	658
SS., white, hard,	142 "	800
" " shelly,	15 "	815
" gray, hard,	36 "	851
" white, hard,	200 "	1051
Slate, black, soft,	16 "	1067
SS., gray, hard,	134 "	1201
Slate and shells, light, soft,	86 "	1287
SS., gray, hard,	30 "	1317
Slate,	68 "	1385
SS., Gas sand, in it,	15 "	1400

Lewis Well (No. 46).

November, 1886.

No. 2, on Lewis farm, Murrysville.

Slate, blue,	50 to	50
SS., white,	20 "	70
Slate, blue,	50 "	120
SS., white,	50 "	170
Slate, black,	140 "	310
SS., gray,	50 "	360
Slate, black,	60 "	420
SS., gray,	100 "	520
Slate and shells, black,	60 "	580
SS., gray,	40 "	620
Slate, red,	20 "	640
Limestone, dark,	25 "	665
SS., gray,	150 "	815
Slate, black,	10 "	825
SS., gray,	30 "	855
Slate, black,	15 "	870
SS., gray,	200 "	1070
Slate and shells, black,	234 "	1304
SS., gray,	37 "	1341
Slate and shells, black,	74 "	1415
SS., gray, open,	35 "	1450

McCutcheon Well (No. 49).

March, 1887.

No. 2, on McCutcheon farm, Murrysville.

Drive pipe,	20 to	20
SS., gray,	15 "	35
Slate, black,	45 "	80
Coal,	3 "	83
Slate, black,	24 "	107
Coal,	2 "	109
Slate, white,	31 "	140
" black,	43 "	183
Coal,	4 "	187
Slate, white,	28 "	215
SS., dark,	10 "	225
Slate, black,	5 "	230
SS., gray, dark, soft, open,	28 "	258
Slate, black,	32 "	290
SS., dark,	25 "	315
Slate, black,	15 "	330
SS., gray,	30 "	360
Slate, black,	12 "	372
SS., gray,	50 "	422
Slate, black,	8 "	430
SS., gray,	90 "	520
Slate, black,	45 "	565
" red,	20 "	585
Limestone, dark,	25 "	610
Slate, black,	5 "	615
SS., gray,	125 "	740
Slate, black,	75 "	815
SS., gray,	185 "	1000
Slate and shells, black (gas at 1060'),	85 "	1085
SS., gray,	25 "	1110
Slate and shells, black,	112 "	1222
SS., gray (considerable gas),	30 "	1252
Slate, black,	60 "	1312
SS., gray,	10 "	1322
Slate, black,	11 "	1333
SS., gray, Gas sand,	18 "	1351

Daum Well.

1885.

Located on the Daum farm, in the Lyons Run district, Penn township, Westmoreland county. Authority, T. J. Vandergrift.

Conductor,	14 to	14
Slate, red,	27 "	41
Limestone, Crinoidal,	3 "	44

Slate, white,	40 to	84
Coal,	3 "	87
Slate,	22 "	109
SS., gray,	25 "	134
Slate,	65 "	199
SS., blue,	33 "	232
Slate,	32 "	264
SS., blue,	15 "	279
Slate, white,	15 "	294
" red,	15 "	309
" white,	10 "	319
Red rock,	7 "	326
SS.,	3 "	329
Slate, white,	30 "	359
" sandy,	51 "	410
SS.,	36 "	446
Coal,	2 "	448
Slate and shells,	40 "	488
Slate, black,	30 "	518
Coal (brackish water),	5 "	523
Slate, white,	25 "	548
Slate and sand,	12 "	560
SS.,	10 "	570
Slate, black,	20 "	590
SS., brown,	15 "	605
Slate and shells,	45 "	650
SS., gray (coal and water in this),	85 "	735
Slate and shells,	80 "	815
SS.,	40 "	855
Coal,	4 "	859
Sand and slate,	55 "	914
SS., white, "Buttermilk sand,"	85 "	999
Sand, slate and shells,	20 "	1019
SS.,	15 "	1034
Slate and shells,	18 "	1052
SS., gray,	168 "	1220
Sand and shells,	40 "	1260
SS., green,	35 "	1295
Slate and shells,	40 "	1335
Sand and slate,	35 "	1370
Slate and shells,	130 "	1500
SS., "Thirty foot sand,"	37 "	1537
Slate and shells,	93 "	1630
Top of Gas sand,		1630

A strong gas well.

Daum Well (No. 11).

1884 and 1887.

No. 1 on Daum farm, Lyon's Run district, Penn township, Westmoreland county. Owners and authority, Philadelphia Gas Co.

Specimen Numbers.				
	Well mouth above ocean in feet (barometer),			1105
	Record not kept to top of Murrysville Gas sand,	1656	to 1656	—551
1.	SS., Murrysville Gas sand,	112	" 1768	—663
2.	Slate, bluish,	22	" 1790	—685
3–4.	SS., white, top fine, bottom coarse and slaty,	65	" 1855	—750
5–6.	Slate purplish, with fine sand,	10	" 1865	—760
7–8.	SS., white and gray, fine, with layers of slate,	20	" 1885	—780
9–11.	Slate, dark,	20	" 1905	—800
12–14.	Slate, dark, sandy,	25	" 1930	—825
15.	Slate, reddish,	2	" 1932	—827
16–17.	Sand shells, greenish-gray, fine,	8	" 1940	—835
18–19.	Slate, purplish, a little red,	10	" 1950	—845
20–21.	Sandy slate, dark-gray and red,	10	" 1960	—855
22–24.	Slate, purplish and red,	15	" 1975	—870
25–26.	Sand shells and slate, dark,	7	" 1982	—877
27.	Slate, dark, and red clay,	8	" 1990	—885
28.	Sand, shell and slate, and red clay,	3	" 1993	—888
29–31.	Slate, dark, purplish, some sandy,	17	" 2010	—905
32.	Slate, sandy,	10	" 2020	—915
33–37.	Slate, gray and red,	25	" 2045	—940
38.	Sand shells and slate,	5	" 2050	—945
39–40.	Slate, dark, sandy at bottom,	15	" 2065	—960
41–42.	Sand shells, white and gray, with slate,	10	" 2075	—970
43.	Sandy slate, black and red,	10	" 2085	—980
44–45.	Sand shells, gray, and red slate,	10	" 2095	—990
46.	SS., yellow-gray, very fine,	5	" 2100	—995
47–51.	Slate, gray, purplish and red, little sandy,	25	" 2125	—1020
52–54.	Slate, red, sandy at bottom,	15	" 2140	—1035
55–57.	Slate, red, and hard sand shells,	15	" 2155	—1050
58–60.	Slate, sandy, gray and red,	18	" 2173	—1068
61.	SS., gray, fine,	7	" 2180	—1075
62.	Slate, red,	10	" 2190	—1085
63–68.	Slate, bluish,	50	" 2240	—1135
69–71.	Sand shells, pebbly, and slate,	8	" 2248	—1143
72–75.	SS., yellowish, top coarse, bottom fine,	22	" 2270	—1165
76–80.	Slate, bluish, some thin sand shells,	52	" 2322	—1217
81–82.	Sand shells, white; and slate,	16	" 2338	—1233
83–85.	SS., light gray, friable, little slate,	22	" 2360	—1255
89–92.	Slate, bluish,	70	" 2430	—1325
93.	Slate, reddish,	5	" 2435	—1330
94–100.	Slate, bluish, sandy in middle, 10 feet,	60	" 2495	—1390

A large gas well in the Murrysville sand; but none of the underlying rocks were productive of either oil or gas. This drill hole passed through the bottom sand of the Venango-Butler group—the Third sand of Oil Creek—at 2360 feet, the group in this locality being 704 feet in thickness, as against about 300 feet on Oil Creek.

Irwin Well.

1885?

Located at Irwin, on the Pennsylvania Railroad, North Huntingdon township, Westmoreland county. Owners, the Irwin Gas and Water Co. Authority, the driller's record.

Well mouth 35′ below Pittsburgh coal.

?,	325 to	325
Shale, drab,	35 "	360
" red,	20 "	380
" olive and brown,	20 "	400
" variegated,	24 "	424
" red,	32 "	456
" variegated,	15 "	471
? "contains a small coal seam,"	40 "	511
Shale, red,	5 "	516
" olive,	24 "	540
Slate, sandy,	10 "	550
" and shale,	20 "	570
Small coal seam,	4 "	574
Shale, variegated,	5 "	579
Limestone,	6 "	585
Shale, green,	5 "	590
Red and olive clay (small coal seam at bottom),	33 "	623
Limestone,	25 "	648
SS.,	10 "	658
Shale, variegated,	4 "	662
SS.,	24 "	686
Limestone,	9 "	695
Shales, variegated,	16 "	711
Slate, sandy (cased at 716′),	23 "	734
" black,	36 "	770
Limestone dark,	19 "	789
Slate, blue,	12 "	801
SS., white, micaceous,	39 "	840
Slate, dark,	31 "	871
Limestone,	8 "	879
? (1½′ of coal),	6 "	885
SS., gray (salt water),	6 "	891
Slate, sandy,	17 "	908
" dark,	13 "	921
Shales, olive,	36 "	957
Slate, sandy,	12 "	969
Limestone,	6 "	975
SS.,	6 "	981
? (seam of rough coal 2′ thick),	9 "	990
Fire clay and sandy slate,	7 "	997
Slate, black,	18 "	1015
" sandy,	15 "	1030

SS., white, mieaceous (salt water),	10 to	1040
Slate, blaek and eoal leader,	25 "	1065
SS., gray,	6 "	1071
Slate, black (gas),	7 "	1078
? good eoal vein 5′ (little sulphur),	6 "	1084
Fire clay and limestone,	5 "	1089
Slate, blaek,	9 "	1098
" drab, sandy (gas),	18 "	1116
SS., light, micaceous,	4 "	1120
Good eoal, no sulphur,	4 "	1124
Fire elay and limestone,	8 "	1132
Shales,	4 "	1136
SS., light, fine-grained,	4 "	1140
Slate, dark, sandy,	13 "	1153
Limestone, sandy,	4 "	1157
SS., gray and fine at top, bottom white,	60 "	1217
Slate,	13 "	1230
Fire clay and sandy slate (1′ of coal),	6 "	1236
Limestone,	3 "	1239
SS., dark brown,	8 "	1247
? (2′ of coal),	4 "	1251
SS., white and brown,	109 "	1360
Slate, black, and coal,	27 "	1387
SS., white and brown (oil show),	28 "	1415
Slate, dark, sandy, small eoal at 1425′,	16 "	1431
SS., gray and brown,	22 "	1453
Slate, dark, sandy,	19 "	1472
Limestone,	6 "	1478
SS., gray and white,	24 "	1502
Shale, dark red, sandy,	25 "	1527
SS., gray, mieaeeous, flaggy,	76 "	1603
Slate, hard,	27 "	1630
Pyrites 3′ and coal 2′,	5 "	1635
Fire elay and blaek slate,	5 "	1640
Coal and slate,	8 "	1648
SS., white, eenter coarse grained,	136 "	1784
Slate, blue,	18 "	1802
SS., white, coarse grained,	55 "	1857
Slate, drab, sandy,	30 "	1887
SS., white, soft,	5 "	1892
Slate, hard, drab,	13 "	1905
SS., gray, hard,	36 "	1941
Shale, drab, dark,	17 "	1958
Slate,	32 "	1990
SS., hard, white,	20 "	2010
Slate, light,	22 "	2032
SS., light,	58 "	2090
Slate, dark,	15 "	2105
SS., gray,	7 "	2112
Slate (mineral water at 2218′),	173 "	2285
SS., gray and brown,	55 "	2340

Unproductive.

Shusted Well (No. 132).

April 28, 1888.

No. 1, on Shusted farm, Grapeville district, Hempfield township, Westmoreland county. Owners and authority, Philadelphia Gas Co.

Clay and slate,	35 to	35
Slate, black,	30 "	65
SS., light,	30 "	95
Slate, light,	110 "	205
SS., light, hard,	35 "	240
Slate, black,	50 "	290
SS., light,	70 "	360
Slate, light,	60 "	420
SS., light, hard,	65 "	485
Slate, blue,	60 "	545
SS., light,	250 "	795
Slate, black,	10 "	805
SS., light, hard,	35 "	840
Slate, light,	10 "	850
SS., light,	50 "	900
Slate and shells,	210 "	1110
SS., light, "30′ rock,"	35 "	1145
Slate and shells,	58 "	1203
SS., stray,	25 "	1228
" light (gas at 1238′),	10 "	1238
" Gas sand, in it,	17 "	1255

McClelland Well (No. 119).

March 13, 1888.

No. 1, on McClelland farm, Latrobe, Westmoreland county. Owners and authority, Philadelphia Gas Co.

Conductor,	28 to	28
Slate, white,	25 "	53
SS., red (1′ of coal),	8 "	61
Slate, white (2′ of coal),	30 "	91
Lime, blue,	10 "	101
Slate, white,	60 "	161
" black,	10 "	171
" white,	30 "	201
" black,	25 "	226
" and shells,	30 "	256
" black,	44 "	300
" and shells,	15 "	315
SS., black,	20 "	335
Slate, black,	40 "	375
" and shells,	50 "	425
SS., white,	75 "	500

SS., gray,	20	to	520
Slate, black,	30	"	550
Lime, gray,	25	"	575
SS., red,	35	"	610
" white,	60	"	670
Slate, black,	14	"	684
SS., gray,	12	"	696
" white,	34	"	730
" gray (gas at 755′, exhausted in 12 hours),	25	"	755
" white,	155	"	910
Slate, black,	5	"	915
SS., gray,	145	"	1060
Slate and shells (little oil at 1145′),	45	"	1105
SS., gray,	10	"	1115
Slate, black,	15	"	1130
SS., white,	18	"	1148
Slate and shells,	12	"	1160
SS., gray,	44	"	1204
Slate, black,	72	"	1276
" and shells (flowing vein fresh water 1287′),	11	"	1287
SS., white,	97	"	1384
" gray,	10	"	1394
Slate, white,	3	"	1397
SS., gray,	8	"	1405
" white,	25	"	1430
" gray,	10	"	1440
" white,	11	"	1451
" gray,	52	"	1503
Shell, hard,	5	"	1508
Slate, black,	62	"	1570
SS., gray,	11	"	1581
SS. and slate, red and gray, alternating,	254	"	1835
Slate, white,	50	"	1885
SS., gray,	15	"	1900
Slate, red,	25	"	1925
SS., gray,	5	"	1930
" white,	5	"	1935
" gray, to bottom,	45	"	1980

Sloan Well (No. 91).

December 2, 1886.

No. 1, on Sloan farm, Blairsville, Westmoreland county. Owners and authority, Philadelphia Gas Co.

Conductor,	40	to	40
Slate and shale, mixed,	410	"	450
SS., gray, close and hard,	150	"	600
Slate and shells, black,	30	"	630
SS., white and gray, close and hard,	470	"	1100
SS. and shale, black,	260	"	1360
SS., pebble, gray and white (gas at top),	25	"	1385

SS. and shale, black,	275 to 1660
SS., red,	50 " 1710
" gray,	55 " 1765
" red,	125 " 1890
" gray,	170 " 2060

Very small; gas sufficient for one stove. Abandoned.

Waltz Mill Well.

1887.

Located on the G. W. Kelley farm, near Waltz mill, Sewickly township, Westmoreland county. Owners and authority, J. M. Guffey & Co.

"Well mouth about 150′ below the Crinoidal limestone."

Conductor,	15 to 15
Slate, white,	100 " 115
SS., white,	160 " 275
Coal,	5 " 280
Slate, black,	20 " 300
SS., black,	50 " 350
Coal,	5 " 355
SS., white,	135 " 490
Slate, black,	30 " 520
SS., white (strong salt water),	30 " 550
Slate, black,	25 " 575
SS., white (salt water),	20 " 595
Slate, black (cased),	15 " 610
Slate, and shells,	115 " 725
SS., white,	150 " 875
SS., black,	10 " 885
SS., white,	190 " 1075
Slate and shells,	150 " 1225
Slate, white,	10 " 1235
SS., white,	8 " 1243
Slate, white,	20 " 1263
Slate, black,	12 " 1275
SS., white,	55 " 1330
Slate and shells,	50 " 1380
SS., gray,	30 " 1410
Slate, white,	15 " 1425
SS., white,	55 " 1480
" gray,	20 " 1500
Slate and shells,	60 " 1560
Slate,	20 " 1580
Slate and shells,	50 " 1630
Red rock,	280 " 1910
Slate, white,	10 " 1920
Red rock,	20 " 1940
SS., gray,	20 " 1960
Slate, white,	10 " 1970

Slate and shells,	15 to	1985
SS., gray (gas.),	20 "	2005
SS., gray and slate,	55 "	2060
Slate and shells,	565 "	2625
SS., gray,	8 "	2633
Slate and shells,	92 "	2725
SS., gray,	12 "	2737
Slate and shells,	263 "	3000
SS., gray,	(?)50 "	3050
Slate, white,	100 "	3150

Unproductive.

Highberger Well.

May, 1889.

Located on the Highberger farm, Sewickly township, Westmoreland county, one mile S. 75° W. of Waltz Mill well. Owner and authority, W. S. Guffey.

"Well commences 60 feet below the Crinoidal limestone."

Conductor,	16 to	16
Slate, white,	12 "	28
Red rock,	8 "	36
Slate and shells,	5 "	41
" white,	50 "	91
Coal,	4 "	95
Slate and shells,	40 "	135
Red rock,	10 "	145
SS., gray,	20 "	165
Slate, black,	50 "	215
" white,	15 "	230
SS., gray,	20 "	250
Slate, white,	13 "	263
SS., gray,	18 "	281
Slate, white,	16 "	297
SS., gray,	50 "	347
Slate, white,	10 "	357
SS.,	5 "	362
Fire clay,	30 "	392
Slate, black,	30 "	422
Limestone,	32 "	454
Slate, black,	15 "	469
Coal,	10 "	479
Slate and shells,	20 "	499
" black,	27 "	526
" white,	15 "	541
SS., gray,	48 "	589
Slate, red,	22 "	611
SS., "80 foot,"	80 "	691
Slate, black (cased 701'),	10 "	701
" white, and shells,	20 "	721
SS., black,	10 "	731

Slate, black,	10 to	741
SS., white,	35 "	776
Red rock,	15 "	791
Slate, white and shells,	10 "	801
Red rock,	40 "	841
SS., Salt water sand,	5 "	846
Limestone,	35 "	881
Slate and shells,	10 "	891
SS., white,	10 "	901
" red,	5 "	906
" white,	145 "	1051
" gray,	110 "	1161
Slate and shells,	20 "	1181
SS., gray,	70 "	1251
Slate and shells,	30 "	1281
SS., white,	80 "	1361
Slate, black,	35 "	1396
SS., hard black,	30 "	1426
Slate, black,	35 "	1461
SS., white,	8 "	1469
Slate and shells,	12 "	1481
SS., hard, white,	60 "	1541
Slate, white and shells,	60 "	1601
SS., white,	35 "	1636
Slate, white and shelly,	15 "	1651
SS., hard, white,	45 "	1696
Slate and shells,	33 "	1729
SS., gray,	30 "	1759
Slate and shells,	10 "	1769

Unproductive.

Hixson Well.

May, 1889.

Located on the David Hixson farm, south of Reagantown, in E. Huntingdon township, Westmoreland county. Owners, Westmoreland and Fayette Natural Gas Co.

Conductor,	24 to	24
Shale,	56 "	80
Limestone and shells,	30 "	110
SS. and shale,	30 "	140
Shale,	20 "	160
SS., white,	105 "	265
Shale, dark,	60 "	325
SS.,	52 "	377
Coal,	3 "	380
SS.,	80 "	460
Shale, sandy,	32 "	492
SS. and shale, dark,	68 "	560
Shale, dark,	12 "	572

SS., white,	25	to	597
Shale and shell (eased at 600'),	12	"	609
" red,	30	"	639
SS., gray,	6	"	645
Shale, blue,	6	"	651
" red,	30	"	681
" " and blue,	12	"	693
Lime, dark,	18	"	711
SS., and shells,	20	"	731
" gray, creamy, fine,	55	"	786
Shale, sandy, black,	35	"	821
SS., white,	79	"	900
Shale, dark,	12	"	912
SS.,	15	"	927
Shale, sandy,	50	"	977
SS., gray,	130	"	1107
Shale, dark and SS.,	60	"	1167
SS., white, pebbles,	25	"	1192
Shale, black and shells,	174	"	1366
SS., dark (little gas),	5	"	1371
" white (little gas),	10	"	1381
" and shale,	8	"	1389
" dark,	20	"	1409
Shale, black, shelly,	40	"	1449
SS., white,	15	"	1464
Shale, black and shells,	176	"	1640
" red,	33	"	1673
SS., red and blue,	36	"	1709
Shale, black and blue,	22	"	1731
" red,	206	"	1937
" black and shells,	36	"	1973
" " and red and shells,	27	"	2000
SS., dark,	14	"	2014
Shale, black and shells, to bottom,	56	"	2070

Unproductive.

Chapter XVI.

New Well Records in the Counties of Beaver and Mercer.
Wheatland Well, No. 1.

1886.

Located near Middlesex, Hickory township, Mercer county. Authority, Wheatland Iron Co.

Drive pipe,	136	to	136
Slate and flags,	44	"	180
SS., gray,	25	"	205
Slate,	15	"	220
SS., oil show,	10	"	230
Slate and shale,	20	"	250
SS., Berea grit,	58	"	308
Slate,	31	"	339
Shale,	2	"	341
Slate,	14	"	355
Shale,	1	"	356
Slate,	17	"	373
Red rock,	32	"	405
Sand and shale,	50	"	455
Slate,	55	"	510
Sand and shale (salt water),	10	"	520
Slate,	30	"	550
Sand and shale,	15	"	565
Slate,	25	"	590
Shale,	5	"	595
Slate and shale,	30	"	625
SS.,	60	"	685
Slate,	145	"	830
Red rock,	3	"	833
Slate,	717	"	1550
SS.,	40	"	1590
Slate and shale,	128	"	1718
Sand and shale,	50	"	1768
Slate,	82	"	1850
Sand and shale,	30	"	1880
Slate, gray, to bottom,	150	"	2030

Unproductive.

Wheatland, No. 2 (deep well).

1887–88.

Located about one mile south of West Middlesex station, and about 30 feet above the RR. track, Hickory township, Mercer county. Owners and authority, Wheatland Iron Company.

Well mouth above ocean, in feet, about . . .			860
Conductor,	15 to	15	845
Slate,	145 "	160	700
SS., gray,	30 "	190	670
Slate,	25 "	215	645
SS.,	20 "	235	625
Slate,	56 "	291	569
SS., "Berea grit" (336′ casing),	60 "	351	509
Slate and shale,	54 "	405	455
Red rock,	35 "	440	420
Sand and shale,	50 "	490	370
Slate,	50 "	540	320
SS.,	10 "	550	310
Slate,	30 "	580	280
Red rock,	15 "	595	265
Slate,	25 "	620	240
Sand and shale,	35 "	655	205
SS.,	50 "	705	155
Slate,	15 "	720	140
Shale and sand,	20 "	740	120
Slate, black,	50 "	790	70
SS.,	1 "	791	69
Slate, black,	24 "	815	+45
Slate and shale (details lost),	1225 "	2040	—1180
Slate, dark,	50 "	2090	—1230
Slate, gray,	50 "	2140	—1280
Slate, dark gray,	85 "	2225	—1365
Slate and shale,	85 "	2310	—1450
Slate, gray,	125 "	2435	—1575
Slate, dark,	40 "	2475	—1615
Slate, gray,	45 "	2520	—1660
Slate, dark,	40 "	2560	—1700
Slate, gray,	40 "	2600	—1740
Red rock, dark,	90 "	2690	—1830
Slate, gray,	120 "	2810	—1950
Slate, dark,	30 "	2840	—1980
Slate, gray,	35 "	2875	—2015
Slate, dark,	10 "	2885	—2025
Red rock, dark,	16 "	2901	—2041
Slate,	74 "	2975	—2115
Slate, gray,	175 "	3150	—2290
Slate, dark,	105 "	3255	—2395
Slate, black, pyrites, "Marcellus,"	50 "	3305	—2445

Slate, dark,	55 to	3360	—2500
Slate, black,	17 "	3377	—2517
Limestone, black to gray, Cherty, "Conniferous,"	107 "	3484	—2624
Bottom in limestone at		3484	

Unproductive.

Cookson Well.

March, 1888.

Belonging to the Bridgewater Gas Co., and located on the Cookson farm, New Sewickley township, Beaver Co. Authority, Bridgewater Gas Co.

Conductor,	10 to	10
SS. (first water),	40 "	50
Slate,	40 "	90
Limestone,	10 "	100
Slate, black,	30 "	130
SS.,	15 "	145
Slate (150′ of 7⅝″ casing),	60 "	205
Coal (water),	2 "	207
Slate, black,	70 "	277
Shells and sand,	30 "	307
Coal (more water),	3 "	310
Slate, white,	40 "	350
" black,	50 "	400
Coal (water and gas),	3 "	403
SS.,	20 "	423
Slate,	100 "	523
Shells,	20 "	543
SS., "First Sand" (653′ of 5⅛″ casing),	100 "	643
Slate,	25 "	668
Shells, hard,	15 "	683
Slate,	40 "	723
Shells, hard,	60 "	783
Slate,	30 "	813
SS.,	20 "	833
Slate,	150 "	983
SS. (gas and water),	160 "	1143
Slate (1153′ of 4¼″ casing),	10 "	1153
Red rock,	40 "	1193
Sand and shells,	30 "	1223
SS., white (strong odor of oil),	20 "	1243
SS., pebbly,	3 "	1246
" white, hard,	55 "	1301
Slate,	110 "	1411
SS., pebbly,	4 "	1415
Slate,	80 "	1495
SS., "Third sand,"	6 "	1501
Slate,	100 "	1601

SS., black,	30 to	1631
Slate, white,	40 "	1671
Red rock,	24 "	1695
Slate,	35 "	1730
Shells,	20 "	1750
Slate,	15 "	1765
Shells,	10 "	1775
Slate,	45 "	1820

Unproductive.

Bryant Well No. 1.

1885.

Located on the Bryant farm, Economy township, Beaver county, about half a mile northerly from Baden. Authority, T. J. Vandergrift.

Well mouth above ocean in feet, about			880
Surface clays, etc.,	19 to	19	861
Limestone,	21 "	40	840
Slate,	30 "	70	810
Iron clay,	30 "	100	780
Limestone,	20 "	120	760
Fire clay,	15 "	135	745
Slate,	340 "	475	405
SS.,	325 "	800	80
Slate,	50 "	850	+ 30
SS.,	85 "	935	— 55
Slate,	185 "	1120	—240
SS.,	42 "	1162	—282
Slate,	88 "	1250	—370
" red,	99 "	1349	—469
SS., Gas rock, in it,	17 "	1366	—486

Economy Well No. 1.

April, 1886.

At Fair Oaks, on north side of Big Sewickley Creek, Harmony township, Beaver county. Owners, Economy Society. Authority, C. J. Hummel, contractor.

Well mouth above ocean in feet (barometer),			710
?	343 to	343	367
Limestone,	17 "	360	350
Slate,	137 "	497	213
SS., gray,	93 "	590	120
SS., black (salt water),	22 "	612	+98
SS., white,	163 "	775	—65
Slate,	67 "	842	—132
SS., white,	23 "	865	—155
Slate,	15 "	880	—170

SS., white,	32 to	912	—202
Slate,	98 "	1010	—300
SS., white,	15 "	1025	—315
SS., gray,	55 "	1080	—370
SS., black,	25 "	1105	—395
SS., gray,	15 "	1120	—410
SS., "Boulder,"	25 "	1145	—435
Slate,	35 "	1180	—470
SS., gray, hard,	55 "	1235	—525
Red rock,	63 "	1298	—588
SS., top pebbly, bottom fine, hard, called "Oil sand,"	62 "	1360	—650
Slate,	265 "	1625	—915
SS., "Gas sand,"	20 "	1645	—935
Slate at bottom,		1645	

A small well.

Hugh & Moore's Well.

September, 1888.

Near Fair Oaks, Beaver county. Authority, Fort Pitt Gas Company.

?	144 to	144	
Coal,	6 "	150	
?	40 "	190	
SS.,	60 "	250	
? (containing 100′ SS.),	250 "	500	
Slate,	100 "	600	
SS., "Big sand,"	200 "	800	
Slate,	20 "	820	
SS.,	80 "	900	
Slate and shells,	315 "	1215	
Red rock,	60 "	1275	
SS., "Shannopin,"	25 "	1300	
Slate,	300 "	1600	
SS. (gas),	6 "	1606	

Boyd Well.

March, 1886.

Owned by S. M. Boyd, and located at Georgetown, Greene township, Beaver county. Authority, S. M. Boyd.

? cased 325′,	730 to	730	
SS., Smith's Ferry sand, say	30 "	760	
?	420 "	1180	
Red rock, say	10 "	1190	
?	113 "	1303	
SS., (oil like Smith's Ferry oil) say	15 "	1318	
? to bottom,	112 "	1430	

Abandoned.

James Johnston Well.

May 4, 1887.

Belonging to the Bridgewater Gas Company, and located on James Johnston's farm, Hopewell township, Beaver county. Authority, Bridgewater Gas Company.

Clay,	12 to	12
Slate,	25 "	37
SS.,	20 "	57
Slate, red,	15 "	72
Slate (110′ of 8″ casing),	132 "	204
Coal,	3 "	207
Slate,	72 "	279
Coal,	2 "	281
Limestone,	37 "	318
Slate,	207 "	525
SS.,	85 "	610
Slate,	15 "	625
SS.,	61 "	686
Slate (700′ of $5\frac{5}{8}$″ casing),	19 "	705
SS.,	80 "	785
Slate,	67 "	852
SS.,	62 "	914
Slate,	50 "	964
SS.,	35 "	999
Slate, sandy,	241 "	1240
SS.,	35 "	1275
Slate and shells,	91 "	1366
Slate, red,	40 "	1406
Slate and shells,	60 "	1466
SS., "Gas sand,"	24 "	1490

McElhaney Well No. 1.

1888.

Located on McElhaney farm, Hopewell township, Beaver county. Owners, United Natural Gas Co. Authority, F. H. Oliphant.

Well mouth above ocean, in feet (Oliphant),			1205
Conductor,	18 to	18	1187
Lime, Crinoidal,	4 "	22	1183
SS., white,	56 "	78	1127
" gray,	32 "	110	1095
" white (133′ of $7\frac{5}{8}$″ casing),	43 "	153	1052
Slate, dark-gray,	50 "	203	1002
" white,	40 "	243	962
SS., white,	30 "	273	932
Slate, white,	60 "	333	872
" black,	25 "	358	847
" white,	30 "	388	817

SS., white,	35 to	423	782
" gray,	35 "	458	747
Slate, dark,	60 "	518	687
" white,	20 "	538	667
SS., white, fine,	37 "	575	630
" dark,	20 "	595	610
" white,	18 "	613	592
Limestone, "Ferriferous,"	30 "	643	562
Slate, white,	17 "	660	545
SS., white,	120 "	780	425
Slate, 20′ black, 10′ white,	30 "	810	395
SS., gray, hard,	35 "	845	360
" white,	60 "	905	300
Slate, black (915′ of $5\frac{5}{8}''$ casing),	10 "	915	290
SS., gray, hard,	85 "	1000	205
Slate and shells, white,	65 "	1065	140
SS., white,	30 "	1095	110
Slate, white,	15 "	1110	95
SS., white,	15 "	1125	80
Slate and shells, white,	50 "	1175	+30
Slate, white,	55 "	1230	—25
SS., white,	25 "	1255	—50
Slate, blue,	15 "	1270	—65
SS., gray,	80 "	1350	—145
Slate and shells,	50 "	1400	—195
SS., white,	35 "	1435	—230
Slate and shells,	30 "	1465	—260
Red rock,	60 "	1525	—320
SS., gray,	12 "	1537	—332
Slate, black,	20 "	1557	—352
SS., Gas sand,	15 "	1572	—367

Brunton Well, No. 1.

September, 1888.

Located on J. P. Brunton farm, near center of east line of Hanover township, Beaver county. Owners, United Natural Gas Company. Authority, contractor's note book.

? (755′ of $5\frac{5}{8}''$ Casing),	805 to	805	
SS.,	30 "	835	
?	15 "	850	
SS.,	225 "	1075	
?	60 "	1135	
SS., (little gas at 1140′),	25 "	1160	
?	175 "	1335	
SS.,	15 "	1350	
?	60 "	1410	
SS.,	30 "	1440	
?	30 "	1470	
SS.,	25 "	1495	
?	25 "	1520	

Red rock,	55 to	1575
?	11 "	1586
SS., "Stray," say	10 "	1596
?	26 "	1622
SS., "Oil sand" to bottom,	22 "	1644

Chapter XVII.

New Well Records in Allegheny county. (1) North of the Ohio river. (2) South of the Ohio river.

Wolf Well (No. 108).

May 3, 1886.

No. 1, on Wolf farm, Tarentum district, East Deer township, Allegheny county. Owners and authority, Philadelphia Gas Company.

Clay,	15 to	15
SS., white,	100 "	115
SS., gray,	100 "	215
Limestone,	15 "	230
Slate and shells,	100 "	330
SS., white,	70 "	400
SS., red, "40′ rock,"	50 "	450
SS., white, "70′ rock,"	90 "	540
Slate, black,	70 "	610
SS., gray, "80′ rock,"	80 "	690
SS., Mountain sand,	180 "	870
Slate and shells,	297 "	1167
SS. (gas),	34 "	1207

Huey Well (No. 109).

June 26, 1886.

No. 1, on Huey farm, Tarentum district, East Deer township, Allegheny county. Owners and authority, Philadelphia Gas Company.

Clay,	15 to	15
SS., gray,	100 "	115
Slate, blue,	50 "	165
SS., gray,	100 "	265
Slate,	100 "	365
SS.,	35 "	400
Slate and shells,	40 "	440
SS., gray,	50 "	490
SS., white,	100 "	590
SS., gray,	50 "	640

SS., white,	80	to	720
SS., gray, Mountain sand,	207	"	927
Slate and shells,	273	"	1200
SS., gray (gas),	43	"	1243

Adams Farm Well.

1887.

Three and a half miles northeast of Tarentum, Harrison township, Allegheny county. Authority, T. J. Vandergrift.

Drive pipe,	19	to	19
Slate,	135	"	154
Coal,	3	"	157
Slate,	43	"	200
Fire clay,	5	"	205
Limestone,	2	"	207
Fire clay,	3	"	210
Slate,	32	"	242
Coal,	4	"	246
Slate, changeable in color,	394	"	640
Limestone,	5	"	645
Shell and slate,	15	"	660
SS., gray,	40	"	700
Slate,	30	"	730
SS., white (cased 744'),	70	"	800
Slate,	25	"	825
SS., white, Mountain sand (first gas),	175	"	1000
SS., changeable in color,	250	"	1250
Sand and shell,	100	"	1350
Slate,	80	"	1430
SS.,	10	"	1440
Sand shells,	20	"	1460
Slate and hard sand shell,	80	"	1540
" "	20	"	1560
"	25	"	1585
SS., "Corn meal,"	32	"	1617
Slate,	5	"	1622
Red rock,	20	"	1642
Slate,	3	"	1645
SS., "Clover seed, called Fifty foot,"	50	"	1695
Slate and shell,	45	"	1740
SS., "Thirty foot,"	25	"	1765
Red rock,	33	"	1798
SS., "Blue Monday,"	8	"	1806
Slate,	5	"	1811
SS., "Boulder" (gas and salt water),	13	"	1824
Slate shell,	19	"	1843
Red rock,	12	"	1855
SS., gray,	30	"	1885
Slate,	5	"	1890

SS., white,	10	to	1900
" red,	5	"	1905
Slate, black,	8	"	1913
SS., gray—white,	27	"	1940
Slate, black,	2	"	1942
SS., white,	18	"	1960
Slate, black, and shells,	45	"	2005
" " to bottom,	5	"	2010

Unproductive.

McGrew Well No. 1.

October, 1887.

Located on Little Pine Creek, O'Hara township, Allegheny county. Owners, McGrew Bros. Authority, Samuel McGrew.

Sandy measures,	80	to	80
Slate and shales (small coal at bottom),	195	"	275
SS., white and gray,	80	"	355
SS., gray and white,	55	"	410
Shale, sandy,	31	"	441
Coal,	3	"	444
Shale,	38	"	482
Coal,	3	"	485
? (salt water at 500′),	15	"	500
SS., hard,	60	"	560
?	20	"	580
Coal (salt water),	2	"	582
Shale, sandy (cased at 600′),	63	"	645
SS.,	35	"	680
Slate, sandy,	45	"	725
SS., 30′ white, 12′ gray,	42	"	767
Slate,	15	"	782
SS., white,	18	"	800
" blue, hard,	30	"	830
" white (*Siliceous limestone on test*),	30	"	860
?	110	"	970
SS., gray, some black slate,	112	"	1082
Slate,	50	"	1132
SS.,	30	"	1162
Slate,	28	"	1190
SS., gray, "Pithole grit,"	25	"	1215
Slate, mostly,	250	"	1465
SS., "stray,"	5	"	1470
Slate,	5	"	1475
SS. (salt water),	100	"	1575
Slate,	35	"	1610
SS., close and hard,	90	"	1700
Slate,	5	"	1705
SS., hard,	20	"	1725

Slate,	50 to	1775
SS., "stray,"	5 "	1780
Slate,	10 "	1790
SS., "30 foot,"	20 "	1810
Slate,	10 "	1820
SS., soft,	18 "	1838
Slate,	3 "	1841
SS.,	6 "	1847
Slate,	23 "	1870
SS.,	8 "	1878
Slate,	5 "	1883
SS.,	12 "	1895
Red rock and slate,	11 "	1906
SS., "Stray,"	5 "	1911
Red rock and slate,	9 "	1920
SS., "Third sand,"	23 "	1943
Slate to bottom,	7 "	1950

Unproductive.

McGrew Well, No. 2.

1888.

Located on Little Pine Creek, O'Hara township, Allegheny county. Owners, McGrew Brothers. Authority, Samuel McGrew.

?	150 to	150
SS.,	5 "	155
?	145 "	300
SS.,	5 "	305
?	115 "	420
SS.,	20 "	440
?	60 "	500
SS.,	15 "	515
?	55 "	570
SS.,	70 "	640
? (685′ casing),	160 "	800
SS.,	120 "	920
?	100 "	1020
SS.,	120 "	1140
?	68 "	1208
SS.,	26 "	1234
?	20 "	1254
SS.,	99 "	1353
?	169 "	1522
SS.,	75 "	1597
?	56 "	1653
SS.,	84 "	1737
?	3 "	1740
SS.,	28 "	1768
?	43 "	1811

SS.,	29 to	1840
?	5 "	1845
SS.,	35 "	1880
?	85 "	1965
SS.,	51 "	2016
?	25 "	2041
SS., to bottom,	19 "	2060

Unproductive.

Armstrong Well.

January, 1889.

Located on the Armstrong farm, north line West Deer township, Allegheny county. Owners, The Allegheny Syndicate. Authority, Wolf & Galey, contractors.

Conductor,	12 to	12
Slate and shells,	358 "	370
Slate,	20 "	390
Coal,	5 "	395
Limestone,	15 "	410
Slate and shells,	200 "	610
SS., "Mountain sands,"	225 "	835
Slate and shells,	50 "	885
SS.,	20 "	905
Slate and shells,	325 "	1230
SS., "Gas sand" (water at 1240'),	97 "	1327
Slate,	40 "	1367
SS., "Hundred foot,"	113 "	1480
Slate,	5 "	1485
SS.,	20 "	1505
Slate,	25 "	1530
Red rock,	6 "	1536
SS., "Thirty foot,"	30 "	1566
Slate,	25 "	1591
SS., "Blue Monday,"	20 "	1611
Slate,	2 "	1613
SS.,	15 "	1628
Slate,	20 "	1648
SS., "Boulder or Third sand,"	25 "	1673
Slate,	30 "	1703
SS., Oil sand, unproductive,	17 "	1720
Slate,	40 "	1760
Red rock,	20 "	1780
Slate,	190 "	1970
SS.,	30 "	2000
Slate and shells to bottom,	243 "	2243

Unproductive.

Preston Well.

1887.

Located about half a mile west of Gibsonia station, in Richland township, Allegheny county. Authority, T. J. Vandergrift.

? (little salt water and gas at 740'),	800 to	800
SS., "Mountain sand" (cased at 574'),	200 "	1000
?	100 "	1100
SS., "First sand,"	20 "	1120
?	255 "	1375
SS., "Gas sand" (salt water at 1430'),	125 "	1500
?	20 "	1520
SS., "Hundred foot,"	129 "	1649
?	51 "	1700
SS., "Thirty foot" (show of oil),	12 "	1712
?	28 "	1740
SS., "Boulder,"	25 "	1765
?	22 "	1787
SS., "Stray,"	13 "	1800
?	32 "	1832
SS., "Third sand,"	3 "	1835
?	45 "	1880
SS., "Fourth sand,"	10 "	1890
Slate and shells,	90 "	1980
Red rock, to bottom,	37 "	2017

Typical Well.

1888.

Located at Brush creek, Marshall township, Allegheny county. Authority, Mr. Fishel.

?	65 to	65
Red rock,	10 "	75
?	190 "	265
Limestone,	10 "	275
?	315 "	590
SS., Sixty foot,	100 "	690
?	590 "	1280
SS., Gas or Salt Water sand, say	70 "	1350
?	70 "	1420
SS., Hundred foot,	100 "	1520
?	80 "	1600
SS., Thirty foot,	15 "	1615
?	41 "	1656
SS., Blue Monday,	23 "	1679
?	17 "	1696
SS., Boulder, say	14 "	1710
?	20 "	1730

SS., Third sand, say	40 to 1770	
?	40 " 1810	
SS., Fourth sand, say	20 " 1830	

This is given by Mr. Fishel as a typical record of the Brush Creek wells.

Fleming Well No. 1.

1885 ?

Located in Sewickley township, Allegheny county. Authority, G. H. Dimick.

Well mouth above ocean in feet (Dimick),		870
? (600′ of casing, gas and salt water at 780′),	1400 to 1490	—530
SS., first sand, pebbles at top, bottom variable in color,	50 " 1450	—580
?	90 " 1540	—670
Sand shells, Second sand, dark-gray, estimated,	10 " 1550	—680
?	150 " 1700	—830
Sand shells, dark-gray (oil show 1710′, gas at 1702′),	15 " 1715	—845
Slate, dark and shells to bottom,	293 " 2008	—1138

Fleming Well No. 2.

1885 ?

Located in Sewickley township, Allegheny county. Authority, G. H. Dimick.

Well mouth above ocean in feet (Dimick),		892
?	85 to 85	807
SS., light-gray,	15 " 100	792
" white, fine,	150 " 250	642
?	130 " 380	512
Sand shell, light, estimated,	10 " 390	502
?	30 " 420	472
SS., dark, and slate (foul gas and much salt water),	30 " 450	+442
? (850′ of $5\frac{5}{8}$″ casing),	972 " 1422	—530
SS., pebbles top, white bottom (oil show 1437′),	62 " 1484	—592
Slate, dark, and a few shells to bottom,	649 " 2133	—1241

Guffey Well.

Located at Wexford, Pine township, Allegheny county. Authority, J. C. Cappeau.

?	1400 to 1400
SS., "Gas sand,"	70 " 1470
?	140 " 1610
SS., "Hundred foot" (oil show at 1650′),	115 " 1725
?	110 " 1835

SS., "Thirty foot" (oil show),	15 to	1850
?	148 "	1998
SS., Fourth sand, (12′ in, 160 pounds pressure of gas),	12 "	2010

Duncan Well.

1885.

Located on the Eli Duncan farm, Pine township, Allegheny county. Authority, G. H. Dimick.

"Well mouth 30 feet above Crinoidal limestone."

?	1472 to	1472
SS. (gas in top followed by salt water),	148 "	1620
Slate, followed by pebbly SS.,	230 "	1850
SS.,	15 "	1865
Slate,	132 "	1997
SS., "stopped in Simpson Gas sand,"	13 "	2010

Duff Well No. 1.

1887.

Located on David Duff's farm, Ohio township, Allegheny county. Authority, G. H. Dimick.

"Well mouth 250 feet above Crinoidal limestone."

?	2070 to	2070
SS., "Mt. Nebo sand" (oil),	28 "	2098
Slate,	18 "	2116

A 20 barrel well.

Mt. Nebo Well No. 1.

1885.

Located in Ohio township, Allegheny county. Authority, John Barr, contractor.

Lime and red rock, about	100 to	100
Soft drilling, no sand,	330 "	430
" "no sand to speak of,"	270 "	700
Sand and slate, four-fifths sand,	100 "	800
Salt water and gas at		800
Sand and slate, four-fifths sand,	100 "	900
Salt water at		900
Most all sand, hard drilling (940′ casing),	370 "	1270
Slate and sand,	300 "	1570
" good drilling,	45 "	1615
SS., soft, brown and gray,	25 "	1640
" white (salt water at 1660′),	75 "	1715

"The well was afterwards drilled deeper and more white sand found."

Thompson Well.

1888.

Located on the H. V. Thompson farm, Ohio township, Allegheny county. Authority, Geo. H. Dimick.

"Well mouth, 130 feet above Crinoidal limestone."

Conductor,	20	to	20
Slate,	20	"	40
SS.,	80	"	120
Slate,	10	"	130
" red rock near top and center,	170	"	300
SS.,	75	"	375
Slate and sand,	275	"	650
Coal,	4	"	654
Slate (probably contains some thin SS.),	266	"	920
" (920′ of $5\frac{5}{8}$″ casing),	15	"	935
SS.,	100	"	1035
Slate,	40	"	1075
SS.,	105	"	1180
Slate,	48	"	1228
SS.,	104	"	1332
Slate, clear and soft,	208	"	1540
SS. (gas and oil in top, salt water at 1560′),	125	"	1665
Slate,	25	"	1690
SS., uniformly dark and close-grained,	89	"	1779
Slate (1782′ of 4″ casing),	25	"	1804
SS.,	10	"	1814
Slate,	45	"	1859
SS.,	10	"	1869
Slate,	46	"	1915
SS.,	11	"	1926
Slate,	25	"	1951
SS.,	44	"	1995
Slate,	15	"	2010
SS.,	26	"	2036
Slate,	43	"	2079
SS., Gas sand,	11	"	2090
Slate to bottom,	150	"	2240

Cook Well.

1886.

Located on the Cook farm, Ohio township, Allegheny county. Authority, Geo. H. Dimick.

"Well mouth 163 feet above Crinoidal limestone."

Conductor,	28	to	28
SS.,	90	"	118
Red rock,	40	"	158
Slate,	12	"	170
Red rock,	36	"	206

Slate,	30 to	236
SS.,	54 "	290
Slate,	110 "	400
SS.,	37 "	437
Slate and shells,	293 "	730
SS.,	14 "	744
Slate,	46 "	790
SS.,	128 "	918
Slate and shells,	40 "	958
SS.,	90 "	1048
Slate (1048′ of $5\frac{5}{8}$″ easing),	47 "	1095
" and shells,	100 "	1195
SS.,	40 "	1235
Slate,	148 "	1383
SS. (salt water, 1751′ of $4\frac{1}{4}$″ casing),	368 "	1751
Slate and shells,	180 "	1931
" white,	54 "	1985
SS., "Mt. Nebo,"	14 "	1999
Slate,	50 "	2049
SS., gas,	20 "	2069

Pinkerton Well.

1887.

Located on the Thos. Pinkerton farm, Ohio township, Allegheny county. Owners, Union Oil Co. Authority, Geo. H. Dimick.

"Well mouth 135 feet above Crinoidal limestone."

Conductor,	22 to	22
SS.,	68 "	90
Red rock,	40 "	130
Slate,	14 "	144
Red rock,	28 "	172
Slate,	47 "	219
Red rock (?),	32 "	251
Slate,	94 "	345
Red rock (?),	52 "	397
Slate,	128 "	525
SS. (salt water),	60 "	585
Slate and shells,	240 "	825
SS. (salt water),	79 "	904
Slate (904′ of $5\frac{5}{8}$″ easing),	20 "	924
SS.,	350 "	1274
Slate,	50 "	1324
SS. (salt water),	320 "	1644
Slate,	30 "	1674
SS. (1708′ of $4\frac{1}{4}$′ easing),	120 "	1794
Slate and shells,	131 "	1925
SS.,	10 "	1935
Slate,	10 "	1945

SS., "Mt. Nebo,"	19 to 1964
Slate,	45 " 2009
SS. (gas),	10 " 2019
Slate,	26 " 2045

Thompson Well.

1887.

Located on the J. Thompson farm, Ohio township, Allegheny county. Authority, Geo. H. Dimick.

"Well mouth 215 feet above Crinoidal limestone."

Conductor,	16 to 16
Slate,	80 " 96
SS.,	70 " 166
Red rock (206′ of 7½″ casing),	40 " 206
Slate,	30 " 236
Red rock,	40 " 276
Slate,	130 " 406
Red rock (?),	28 " 434
Slate,	166 " 600
SS.,	30 " 630
Slate,	234 " 864
SS. (1004′ of 5⅝″ casing),	140 " 1004
Slate and shells (?),	626 " 1630
SS., "Hundred foot" and "Second" (salt water),	216 " 1846
Slate and shells (1846′ of 4¼″ casing),	178 " 2024
SS., "Mt. Nebo," or "Fourth SS.,"	32 " 2056
Slate,	20 " 2076
SS., "Fifth or Simpson Gas sand,"	15 " 2091

"This obtained from Union Oil Co. Think it carelessly kept, except as to two lower sands. Elevation of Crinoidal limestone fixed by myself."

G. H. D.

Crawford Well.

1888.

Located on the J. M. Crawford farm, Ohio township, Allegheny county. Authority, Geo. H. Dimick.

"Well mouth 165 feet below Crinoidal limestone."

Conductor,	11 to 11
SS.,	26 " 37
Slate,	38 " 75
" white fire clay (?),	20 " 95
" (149′ of 7⅝″ casing),	85 " 180
SS.,	65 " 245
Slate,	97 " 342
Bituminous shale (gas),	6 " 348

Fire clay,	5 to	353
Slate,	7 "	360
SS.,	20 "	380
Slate,	12 "	392
SS.,	20 "	412
Slate,	68 "	480
SS.,	22 "	502
Slate (505′ of $5\frac{5}{8}$″ casing),	31 "	533
SS.,	15 "	548
Slate,	64 "	612
SS.,	13 "	625
Slate, black (gas),	4 "	629
SS.,	78 "	707
Slate,	53 "	760
SS., close and very hard,	151 "	911
Slate,	37 "	948
SS.,	102 "	1050
Slate,	15 "	1065
SS.,	50 "	1115
Slate, sandy (gas at 1250′),	150 "	1265
SS. (gas at top, oil at 15′, salt water flowing at 30′),	105 "	1370
Slate,	30 "	1400
SS., uniformly white and close,	111 "	1511
Slate,	14 "	1525
SS. (heavy flow salt water),	8 "	1533
Slate,	7 "	1540
SS. (salt water),	6 "	1546
Slate,	22 "	1568
SS. (salt water),	10 "	1578
Slate (1581′ of $4\frac{1}{4}$″ casing),	7 "	1585
SS.,	28 "	1613
Slate,	7 "	1620
SS., top 10 reddish (gas at 1635′),	23 "	1643
Slate,	17 "	1660
SS. (show oil 1665),	20 "	1680
Slate,	15 "	1695
SS.,	16 "	1711
Slate,	8 "	1719
SS., white (slate at 1745′, oil at 1751′),	44 "	1763
Slate, black,	17 "	1780
SS., top coarse, bottom pebbly (oil and gas),	22 "	1802
Slate,	73 "	1875

Smith Well.

1886.

Located on the G. W. Smith farm, Ohio township, Allegheny county. Authority, Geo. H. Dimick.

"Well mouth 100 feet below Crinoidal limestone."

Conductor,	15 to	15
Slate,	10 "	25

SS.,	120	to	145
Coal blossom, slate, etc.,	50	"	195
SS.,	50	"	245
Slate,	12	"	257
SS. and slate partings,	78	"	335
Slate,	15	"	350
SS., dark grey,	50	"	400
Slate and shale (556′ of $5\frac{5}{8}''$ casing),	222	"	622
SS. in slate, irregular,	68	"	690
" top white, coarse, bottom dark,	300	"	990
Slate,	35	"	1025
Shells,	10	"	1035
SS.,	95	"	1130
Slate,	72	"	1202
SS.,	28	"	1230
Slate,	110	"	1340
SS., white, coarse (oil and gas in top, salt water 18′),	102	"	1442
Slate,	15	"	1457
SS., bluish top, white bottom, fine,	133	"	1590
Slate (1630′ of $4\frac{1}{4}''$ casing),	75	"	1665
SS.,	16	"	1681
Slate,	17	"	1698
SS., "Clover seed," reddish at bottom,	10	"	1708
Slate 3′, sand shells 9′, slate 8′,	20	"	1728
SS., little oil,	18	"	1746
Slate and sand shells,	46	"	1792
SS., white, fine (gas at top, oil at bottom),	28	"	1820
Slate,	40	"	1860
SS.,	3	"	1863
Slate, soft,	4	"	1867
SS., "Simpson Gas sand,"	17	"	1884
Slate, to bottom,	56	"	1940

J. Hohman Well.

1887.

Located on the J. Hohman farm, Ohio township, Allegheny county. Authority, Geo. H. Dimick.

"Well mouth 70 feet below Crinoidal limestone."

Conductor,	18	to	18
Slate,	32	"	50
Red rock,	18	"	68
Slate,	32	"	100
SS.,	42	"	142
Slate (146′ of $7\frac{1}{2}''$ casing),	88	"	230
SS.,	76	"	306
Slate,	14	"	320
" very black, coal at bottom,	18	"	338
"	92	"	430
Bituminous shale, gas,	15	"	445
Slate,	179	"	624

Bituminous shale,	5	to	629
Slate,	31	"	660
SS.,	50	"	710
Slate (730′ of $5\frac{5}{8}$″ casing),	24	"	734
SS., gray,	46	"	780
" reddish,	10	"	790
" blue,	25	"	815
" white,	200	"	1015
Slate,	25	"	1040
Sand,	126	"	1166
Slate,	40	"	1206
Sand,	84	"	1290
Slate,	132	"	1422
SS. (salt water),	50	"	1472
Slate,	25	"	1497
SS., white (salt water),	58	"	1555
" blue (salt water),	30	"	1585
Slate (1602′ of 4″ casing),	29	"	1614
SS., pebbly (gas),	16	"	1630
Slate,	38	"	1668
SS.,	14	"	1682
Slate,	7	"	1689
SS.,	5	"	1694
Slate,	8	"	1702
Sand,	33	"	1735
Slate,	75	"	1810
SS., "Mt. Nebo,"	25	"	1835
Slate,	44	"	1879
SS., pebbles in top (gas),	10	"	1889

Goode Well.

1886.

Located on Goode's ten acre plot, in Ohio township, Allegheny county. Authority, Geo. H. Dimick.

"Well mouth 65 feet below Crinoidal limestone."

Conduetor,	7	to	7
Slate,	588	"	595
SS.,	12	"	607
Slate (612′ of $7\frac{1}{2}$″ casing),	28	"	635
Bituminous shale (gas),	6	"	641
Slate,	94	"	735
Sand,	285	"	1020
Slate,	18	"	1038
SS.,	126	"	1164
Slate, sandy and shelly,	201	"	1365
SS. (salt water),	105	"	1470
Slate,	16	"	1486
SS., "Hundred foot rock" (salt water, 1560′ of $5\frac{5}{8}$″ easing),	114	"	1600
Slate,	20	"	1620

SS.,	15 to 1635
Slate,	40 " 1675
" sandy and shelly,	101 " 1776
"	29 " 1805
SS.,	9 " 1814
Slate,	26 " 1840
SS., "Mt. Nebo,"	6 " 1846
Slate,	42 " 1888
SS., pebbly (gas),	3 " 1891
Slate,	52 " 1943

Wright Well.

1888.

Located on the Robert C. Wright farm, Franklin township, Allegheny county. Authority, Geo. H. Dimick.

"Well mouth 194 feet above Crinoidal limestone."

Conductor,	13 to 13
Slate,	82 " 95
Coal,	1 " 96
SS.,	38 " 134
Slate,	10 " 144
SS.,	10 " 154
Slate (170′ of 8″ casing),	25 " 179
Red rock,	15 " 194
Slate, muddy,	8 " 202
Red rock,	20 " 222
Slate,	78 " 300
Red rock,	20 " 320
Slate,	75 " 395
SS.,	30 " 425
Slate,	66 " 491
Hard shells,	2 " 493
Slate,	101 " 594
Coal,	8 " 602
Slate, black,	15 " 617
SS.,	6 " 623
Slate,	48 " 671
Coal,	5 " 676
Slate,	5 " 681
SS.,	7 " 688
Slate,	22 " 710
Coal (water),	13 " 723
SS.,	42 " 765
Slate,	36 " 801
SS.,	10 " 811
Shells,	77 " 888
Shells, very hard,	2 " 890
Slate,	40 " 930
SS.,	20 " 950
Shelly (958′ of 6″ casing),	51 " 1001

SS., white,	239 to	1240
Slate,	32 "	1272
SS.,	116 "	1388
Slate,	249 "	1637
SS. (salt water),	113 "	1750
Slate,	5 "	1755
SS., yellow and white pebbles (salt water),	69 "	1824
Slate and shells, layer of red,	25 "	1849
SS., white (1843′ of 4½″ casing),	10 "	1859
Slate,	19 "	1878
SS.,	10 "	1888
Slate,	30 "	1918
" sandy,	25 "	1943
"	44 "	1987
SS.,	17 "	2004
Slate,	66 "	2070
SS., "Mt. Nebo" (gas),	30 "	2100
Slate,	35 "	2135
SS., "Gas sand,"	12 "	2147
Slate,	3 "	2150

H. Hohman Well.

1887.

Located on the H. Hohman farm, Franklin township, Allegheny county. Authority, Geo. H. Dimick.

"Well mouth 90 feet below Crinoidal limestone."

Conductor,	26 to	26
SS. and red rock,	14 "	40
Slate,	68 "	108
SS.,	46 "	154
Slate,	89 "	243
SS.,	63 "	306
Slate (312′ of 7⅝″ casing),	92 "	398
SS.,	20 "	418
Coal (water),	8 "	426
Slate,	15 "	441
SS.,	27 "	468
Slate,	67 "	535
Coal,	6 "	541
Slate,	57 "	598
SS.,	17 "	615
Slate,	31 "	646
SS. (salt water),	34 "	680
Slate (728′ of 5⅝″ casing),	63 "	743
SS., reddish,	25 "	768
" white,	221 "	989
Slate,	40 "	1029
SS.,	96 "	1125
Slate,	261 "	1386
SS. (salt water, some gas),	100 "	1486

Slate,	19	to	1505
SS., "Hundred foot" (oil in pebble at 1540′ and 55′),	65	"	1570
Slate (1574′ of 4″ casing),	8	"	1578
SS.,	12	"	1590
Slate,	29	"	1619
SS.,	18	"	1637
Slate, shelly,	82	"	1719
SS., "Clover seed,"	9	"	1728
Slate,	80	"	1808
SS., "Mt. Nebo" (gas and spray of oil),	24	"	1832
Slate,	48	"	1880
SS. (black oil),	8	"	1888
Slate,	4	"	1892
SS. (some gas),	13	"	1905

Hetzel Well.

1887.

Located on the J. A. Hetzel farm, Franklin township, Allegheny county. Authority, Geo. H. Dimick.

"Well mouth 175 feet above Crinoidal limestone."

Conductor,	23	to	23
SS.,	126	"	149
Slate,	10	"	159
Red rock,	6	"	165
Slate (170′ of $7\frac{1}{2}$″ casing),	10	"	175
Limestone (?),	4	"	179
Red rock,	30	"	209
Slate,	161	"	370
SS.,	16	"	386
Slate,	24	"	410
SS.,	15	"	425
Slate,	75	"	500
SS.,	20	"	520
Slate,	55	"	575
SS. (gas),	15	"	590
Bituminous shale,	15	"	605
Slate,	185	"	790
SS.,	20	"	810
Slate,	15	"	825
SS.,	12	"	837
Slate, bituminous shale at bottom,	32	"	869
SS. (gas),	61	"	930
Slate (930′ of $5\frac{5}{8}$″ casing),	50	"	980
SS.,	240	"	1220
Slate,	48	"	1268
SS.,	122	"	1390
Slate,	50	"	1440
" sandy and shelly,	192	"	1632
SS. (salt water),	78	"	1710

Slate,	27 to 1737
SS., white 73′, slate 1′, blue SS. 25′ (salt water),	99 " 1836
Slate (1844′ of 4″ casing),	22 " 1858
SS.,	12 " 1870
Slate,	60 " 1930
SS.,	15 " 1945
Slate,	27 " 1972
SS.,	11 " 1983
Slate,	65 " 2048
SS., "Mount Nebo" (gas at 2068′),	35 " 2083
Slate,	35 " 2118
SS., pebbles in top (gas all through),	14 " 2132

Simpson Well.

1885.

Located on Simpson farm, Franklin township, Allegheny county. Authority, G. H. Dimick.

"Well mouth 25 feet below Crinoidal limestone."

?	1820 to 1820
SS.,	5 " 1825
Slate,	40 " 1865
SS., slate in middle, "Mt. Nebo sand,"	48 " 1913
Slate,	32 " 1945
SS., "Simpson Gas sand,"	10 " 1955

Glenn Well.

Fall of 1888.

Located in S. E. corner of McCandless township, Allegheny county. Owners, Gibson, Giles & Co. Authority, G. H. Dimick.

"Crinoidal limestone at well mouth."

Slate,	56 to 56
SS.,	64 " 120
Slate,	250 " 370
SS. (salt water),	60 " 430
Slate,	233 " 663
SS.,	15 " 678
Slate,	30 " 708
SS. and slate,	56 " 764
Slate (784′ of $6\frac{1}{4}$″ casing),	30 " 794
SS., hard, fine,	30 " 824
Slate,	50 " 874
SS.,	174 " 1048
Slate,	42 " 1090
SS.,	15 " 1105
Slate and shells,	95 " 1200
"	227 " 1427

SS. (salt water),	90 to	1517
Slate (1534′ of $4\frac{3}{4}''$ casing),	38 "	1555
SS.,	53 "	1608
Slate,	7 "	1615
SS.,	25 "	1640
Slate,	22 "	1662
SS., reddish,	18 "	1680
Slate,	42 "	1722
SS.,	28 "	1750
Slate,	20 "	1770
SS., reddish,	12 "	1782
SS.,	34 "	1816
Slate,	44 "	1860
SS., "Third sand,"	25 "	1885
Slate,	55 "	1940
SS., gray, "Fourth sand,"	5 "	1945
Slate, to bottom,	165 "	2110

Hartman Well.

1886.

Located on the M. Hartman farm, Ross township, Allegheny county. Authority, Geo. H. Dimick.

"Well mouth 135 feet below Crinoidal limestone."

Conductor,	12 to	12
SS.,	80 "	92
Slate and shells,	78 "	170
Limestone,	10 "	180
Slate and shells,	125 "	305
SS., white,	48 "	353
Slate,	15 "	368
Coal,	2 "	370
Fire clay,	12 "	382
Slate (505′ of $5\frac{5}{8}''$ casing),	193 "	575
Bituminous shale (strong gas),	5 "	580
Slate,	30 "	610
SS., whitish,	40 "	650
Slate,	35 "	685
SS.,	135 "	820
Slate,	17 "	837
SS.,	123 "	960
Slate, with thin streaks of sand,	168 "	1128
" clear,	32 "	1160
" and shells,	240 "	1400
SS., variable (salt water all through, gas at 1518′),	172 "	1572
Slate, shelly at top, clear at bottom,	28 "	1600
SS., white, pebbly (1000 bbls. salt water per day),	14 "	1614
Slate (1620′ of $4\frac{1}{4}''$ casing),	36 "	1650
SS., dark-gray,	4 "	1654
Slate,	24 "	1678

SS., light,	16 to	1694
Slate,	16 "	1710
SS., gray (little gas),	15 "	1725
Slate,	23 "	1748
SS., light (show of oil),	8 "	1756
Slate, black, soft,	23 "	1779
SS., dark and close,	13 "	1792
Slate,	4 "	1796
SS., white, with dark streaks,	19 "	1815
Slate,	40 "	1855
SS., gray, "Simpson Gas sand" (little gas),	6 "	1861
Slate,	28 "	1889
SS., light,	14 "	1903
Slate, to bottom,	12 "	1915

Sweet Home Well.

February, 1889.

Located on farm of Fred Schwitter, Ross township, Allegheny county. Owners, G. H. Dimick, *et al.* Authority, G. H. Dimick.

"Well mouth 3 feet below Crinoidal limestone."

Conductor,	12 to	12
Slate, shelly, upper part ferruginous,	88 "	100
Red rock, sandy,	12 "	112
Slate, shelly,	53 "	165
SS.,	61 "	226
Slate (229′ of $8\frac{1}{4}$″ casing),	4 "	230
Limestone, dark-gray,	20 "	250
Slate,	60 "	310
SS.,	75 "	385
Slate,	26 "	411
Coal (gas),	3 "	414
SS.,	6 "	420
Fire clay,	6 "	426
Slate,	20 "	446
SS.,	40 "	486
Coal (gas),	6 "	492
Slate,	83 "	575
Limestone,	15 "	590
Slate, shelly (gas),	35 "	625
" clear,	15 "	640
Limestone,	12 "	652
SS.,	48 "	700
Shale, bituminous,	3 "	703
SS., very fine, hard,	15 "	718
Slate,	107 "	825
Limestone,	20 "	845
Slate,	4 "	849
SS., gray, very hard (900′ of $6\frac{1}{4}$″ casing),	94 "	943

Slate,		9 to 952
SS., close, hard, gray,		188 " 1140
Slate,		30 " 1170
SS.,		25 " 1195
Slate, shelly,		35 " 1230
SS.,		32 " 1262
Slate, upper half somewhat sandy,		208 " 1470
SS., fine, white (gas and water),		146 " 1616
Slate,		14 " 1630
SS., reddish at top (gas and water),		76 " 1706
Slate (1708′ of $4\frac{1}{4}$″ casing),		4 " 1710
SS. (little salt water),		4 " 1714
Slate, bluish, shelly,		59 " 1773
SS., fine-grained, hard, light-colored,		40 " 1813
Slate, black,		3 " 1816
SS., gray,		9 " 1825
Slate, black, soft,		12 " 1837
SS., fine, white, hard, dark at bottom,	10	
" "clover seed" at top, (no oil nor gas),	8	
" coarse and light (no oil nor gas),	12	
" pebbly (oil show),	5	
" dark, finer, flaky at bottom,	8	82 " 1919
" lighter,	6	
" light and fine (gas),	8	
" coarse, pebbles (gas increasing),	14	
" hard, fine, gray,	11	
Slate, dark, soft,		26 " 1945
SS., compact, small pebbles,	8	
" gray, coarse (oil show),	10	41 " 1986
" light-colored, very hard, fine,	23	
Slate, black,		28 " 2014
SS., gray, few small pebbles in top,		15 " 2029
Slate, to bottom,		8 " 2037

"Strong flow of gas at 1485′, followed by large amount of salt water at 1490′, which the gas threw over the derrick until shut in with a gate valve and drowned out by the water.

"Gas and show of oil at 1634′, followed by salt water at 1660′. This gas also threw the water over the derrick and had to be overcome in the same manner as the first; when it was cased off at 1708′."

Dixmont Well No. 2.

Fall of 1888.

Located on east bank of Tom's Run, just north of RR. at Dixmont, Allegheny county. Authority, G. H. Dimick.

"Well mouth 250 feet below Crinoidal limestone."

Drive pipe (8″ casing),	22	to	22
SS., dark-grey,	44	"	66
Slate, sandy and shelly,	184	"	250
"	48	"	298
SS.,	16	"	314
Slate,	86	"	400
SS.,	38	"	438
Slate,	16	"	454
Coal or bituminous shale,	6	"	460
Slate,	20	"	480
SS. (salt water),	86	"	566
Slate,	90	"	656
SS., white, coarse (salt water),	30	"	686
" gray, finer (747′ of 6¼″ easing),	134	"	820
Slate, with thin streaks of sand,	140	"	960
" shelly,	336	"	1296
SS., white, fine (no salt water, oil show 1326′),	104	"	1400
Slate and shells (1401′ of 4½″ easing),	80	"	1480
SS., gray,	56	"	1536
Slate,	26	"	1562
SS., "Mt. Nebo" (little gas),	11	"	1573
Slate, shelly,	38	"	1611
SS. (oil and gas shows),	28	"	1639
Slate and shells,	41	"	1680
SS.,	2	"	1682
Slate,	4	"	1686
SS., "Simpson Gas sand" (no gas),	6	"	1692
Slate, to bottom,	110	"	1802

Neville Island Well No. 1.

1886.

Located near the middle of Neville Island, Allegheny county, about 7 miles below Pittsburgh. Authority, Geo. H. Dimick.

"Well mouth 300 feet below Crinoidal limestone."*

Drive pipe,	58	to	58
? (536′ of 5⅝″ casing),	478	"	536
Slate,	64	"	600
SS.,	280	"	880
Slate and shells,	300	"	1180
" shelly, with streaks of sand,	120	"	1300
SS.,	110	"	1410
Slate,	35	"	1445
SS.,	10	"	1455
Slate,	30	"	1485

*This exposure is so far in a northerly direction from well that it is doubtless 20 or 25 feet too high.—G. H. D.

Sandy shells,	20 to	1505
SS.,	12 "	1517
Slate,	45 "	1562
SS.,	15 "	1577
Slate,	25 "	1602
SS., "Mt. Nebo" (black oil at top, gas at 1622′),	31 "	1633
Slate,	42 "	1675
Stopped in "Simpson Gas sand,"	11 "	1686

Neville Island Well No. 2.

February, 1887.

Located on Neville Island, Allegheny county, about 7 miles below Pittsburgh. Owners, J. M. Guffey & Co. Authority, J. H. Patterson, contractor, per owners.

"Well mouth 305 feet below Crinoidal limestone."

Drive pipe,	54 to	54
Slate,	2 "	56
Coal,	6 "	62
Slate,	120 "	182
SS., white,	15 "	197
Slate,	71 "	268
Sand shell,	5 "	273
Slate,	25 "	298
Sand shell,	6 "	304
Slate,	15 "	319
SS., white,	101 "	420
Slate,	50 "	470
SS., white,	35 "	505
Slate (546′ of $5\frac{5}{8}$″ casing),	60 "	565
SS., gray,	40 "	605
Slate,	10 "	615
SS., gray,	175 "	790
Slate,	50 "	840
SS., gray,	62 "	902
Slate,	10 "	912
SS., white,	34 "	946
Slate,	181 "	1127
SS., gray,	20 "	1147
Slate,	120 "	1267
SS., gray,	20 "	1287
Slate,	15 "	1302
SS., "Salt water sand,"	110 "	1412
Slate (1415′ of 4″ casing),	58 "	1470
SS., white,	10 "	1480
Slate,	15 "	1495
SS., gray,	15 "	1510
Slate,	30 "	1540
SS., white,	20 "	1560
Slate,	25 "	1585

SS., white, "Mt. Nebo sand,"	30 to	1615
Slate,	56 "	1671
SS., "Gas sand,"	15 "	1686

Bragdon Well.

September, 1887.

Located on the Bragdon farm, about one-half mile from head of Neville Island, Allegheny county. Owners, J. H. Galey, *et al.* Authority, G. H. Dimick.

Well mouth above ocean, in feet,			720
Drive pipe (8″ easing),	70 to	70	650
SS., reddish,	3 "	73	647
Fire clay,	5 "	78	642
Slate,	7 "	85	635
SS., black,	15 "	100	620
Slate,	10 "	110	610
Coal,	5 "	115	605
Slate,	160 "	275	445
Coal,	8 "	283	437
Slate,	52 "	335	385
Limestone, reddish,	30 "	365	355
Slate,	55 "	420	300
SS., salt water,	5 "	425	295
Slate,	35 "	460	260
SS., dark,	30 "	490	230
Slate, shelly (511′ of 6¼″ easing),	130 "	620	100
SS., white,	65 "	685	35
Slate, shelly,	30 "	715	+5
SS.,	185 "	900	—180
Slate, shelly,	72 "	972	—252
SS., very hard,	8 "	980	—260
Slate, shelly,	212 "	1192	—472
SS.,	40 "	1232	—512
Slate, shelly (salt water at 1240′),	95 "	1327	—607
SS., white, hard (gas and oil at 1388′),	122 "	1449	—729
Slate,	58 "	1507	—787
SS.,	51 "	1558	—838
Slate,	20 "	1578	—858
SS.,	35 "	1613	—893
Slate,	6 "	1619	—899
SS. (gas),	31 "	1650	—930
Slate,	32 "	1682	—962
SS., blue, flaky, "Simpson Gas sand,"	40 "	1722	—1002
Slate,	49 "	1771	—1051
SS., pebbly (oil show),	10 "	1781	—1061
Slate, to bottom,	56 "	1837	—1117

"Gas and two or three barrels of oil per day in the 'Hundred foot rock' at 1388′, but soon exhausted. This

sand, usually full of salt water in this region, produced less than was required to supply the sandpump in drilling."

"This well commenced about 275′ below the Crinoidal limestone."

(2) *Wells South of the Ohio River.*

Hayes Crossing Well No. 1.

February 15, 1885.

No. 1, Hayes Crossing district, Collier township, Allegheny county. Owners and authority, Philadelphia Gas Co.

Well mouth above ocean, in feet (P. G. Co.),				1090
Below Pittsburgh Coal, 190′.				
Gravel,	5	to	5	1085
SS.,	25	"	30	1060
Fire clay,	75	"	105	985
SS., white,	75	"	180	910
" blue,	25	"	205	885
Slate, white,	200	"	405	685
SS., gray,	15	"	420	670
Slate, black,	20	"	440	650
SS., pebbly (gas),	10	"	450	640
Slate, white,	30	"	480	610
Coal (water),	5	"	485	605
Fire clay,	15	"	500	590
Slate, black,	25	"	525	565
Coal (water),	12	"	537	553
Slate, gray,	30	"	567	523
SS., gray,	13	"	580	510
Slate and shells,	120	"	700	390
SS. (gas and water),	25	"	725	365
Slate, black,	25	"	750	340
SS., white (water),	50	"	800	290
Slate, black (cased at 820′),	50	"	850	+240
SS., black to gray,	300	"	1150	—60
Slate, gray,	100	"	1250	—160
SS., (gas,)	50	"	1300	—210
Slate, black,	75	"	1375	—285
SS., blue,	25	"	1400	—310
Slate, gray,	100	"	1500	—410
SS., white,	25	"	1525	—435
Slate, black,	25	"	1550	—460
SS., gray,	50	"	1600	—510
Slate and shells,	25	"	1625	—535
SS., blue,	25	"	1650	—560
Red rock,	25	"	1675	—585
SS., stray,	25	"	1700	—610

Slate, black,	15 to 1715	—625
SS., coffee-colored (water and gas),	10 " 1725	—635
" pebbly,	5 " 1730	—640
" blue,	10 " 1740	—650
" white, pebbly (gas),	15 " 1755	—665
Slate, gray,	95 " 1850	—760
SS., pebbles (gas),	5 " 1855	—765
" white,	10 " 1865	—775
" blue,	10 " 1875	—785
Slate, gray,	30 " 1905	—815
SS., pebbles, black,	7 " 1912	—822
Slate and shells,	488 " 2400	—1310

Oakdale Well.

February, 1887.

Located on the McKee farm, 2½ to 3 miles north of Oakdale station, on the Pan Handle RR., in North Fayette township, Allegheny county. Authority, T. J. Vandergrift.

Surface,	8 to	8
Limestone,	40 "	48
Slate,	150 "	198
SS., white,	150 "	348
" gray,	75 "	423
Red rock,	10 "	433
Slate,	25 "	458
SS., hard,	20 "	478
Slate,	5 "	483
Coal (10′ of coal and 10′ of black muck),	20 "	503
Slate and sand, shelly drilling,	175 "	678
Slate,	40 "	718
SS., (salt water,)	25 "	743
Slate and shells,	57 "	800
Soft caving rock,	20 "	820
SS., hard,	80 "	900
Slate,	20 "	920
SS., Salt water sand,	20 "	940
Caving rock,	10 "	950
SS., Salt water sand,	60 "	1010
Slate (cased at 1020′),	20 "	1030
SS., hard,	40 "	1070
Slate,	25 "	1095
SS., white, close,	315 "	1410
Slate and shells (little water and gas at 1500′),	100 "	1510
SS., First sand, about 5′ of slate in center,	16 "	1526
Slate and shells,	184 "	1710
SS., hard,	50 "	1760
Red rock,	10 "	1770
Slate and shells, say	120 "	1890
SS. (salt water 3 bits in, oil afterwards),	49 "	1939

Slate,	133 to 2072
SS. (good flow of gas),	12 " 2084
Slate,	21 " 2105
SS., blue, close,	10 " 2115
Slate, to bottom,	49 " 2164

Nesbitt Well (No. 115).

May 27, 1887.

No. 1, on W. K. Nesbitt farm, Middletown district, Moon township, Allegheny county. Owners and authority, Philadelphia Gas Co.

Clay,	30 to 30
Slate, white,	90 " 120
Red rock,	60 " 180
SS., blue,	15 " 195
Slate, white,	120 " 315
SS., white,	85 " 400
Slate, black,	180 " 580
" white,	75 " 655
Coal,	5 " 660
Slate, white,	25 " 685
SS., blue,	15 " 700
" red,	15 " 715
" gray,	5 " 720
Slate, white,	50 " 770
SS., white (salt water),	70 " 840
Slate, black (salt water),	20 " 860
SS., gray,	25 " 885
Slate, white,	5 " 890
SS., gray,	20 " 910
Slate, black,	20 " 930
SS., gray,	20 " 950
Slate, white,	5 " 955
SS., white,	95 " 1050
Slate, black,	50 " 1100
SS., white,	75 " 1175
Slate and shells, white,	105 " 1280
SS., white,	15 " 1295
Slate, white,	55 " 1350
SS., white,	40 " 1390
Slate and shells, white,	200 " 1590
SS., black,	25 " 1615
Slate, white,	20 " 1635
SS., black,	35 " 1670
Slate, white,	35 " 1705
Pink rock,	65 " 1770
SS., white, Stray,	10 " 1780
" soft,	520 " 2300

Unproductive.

Stoop's Ferry Well.

Located near Stoop's Ferry, Moon township, Allegheny county. Authority, T. J. Vandergrift.

Conductor,	25	to	25
Fire clay,	5	"	30
Slate, hard,	5	"	35
Limestone,	6	"	41
Slate,	4	"	45
SS., hard,	65	"	110
Slate,	29	"	139
SS.,	21	"	160
Slate and shells,	40	"	200
Fire clay,	40	"	240
Slate, black,	40	"	280
SS., white, pebbly,	25	"	305
Slate,	15	"	320
SS.,	15	"	335
Slate (cased 350′),	20	"	355
SS.,	10	"	365
Slate, sand and shells (gas at 380′),	75	"	440
Coal and salt water,	6	"	446
Slate,	29	"	475
? (a little gas at 475′),	65	"	540
SS.,	35	"	575
Slate,	6	"	581
SS.,	15	"	596
Slate and shells,	237	"	833
SS.,	140	"	973
Slate,	57	"	1030
SS.,	25	"	1055
Slate,	25	"	1080
SS. (gas),	30	"	1110
Slate,	20	"	1130
SS.,	270	"	1400
Slate,	25	"	1425
Red rock,	35	"	1460
Slate,	40	"	1500
SS., light-colored,	10	"	1510
" black, with white pebbles (salt water),	60	"	1570
Slate and shells, to bottom,	230	"	1800

McCleister Well No. 1.

April 30, 1886.

No. 1, on McCleister farm, Shoustown district, Crescent township, Allegheny county. Owners and authority, Philadelphia Gas Co.

Conductor,	6	to	6
Limestone,	30	"	36

Red rock,	100 to	136
SS., white,	10 "	146
Slate, black,	125 "	271
Shells,	6 "	277
Slate, white,	40 "	317
SS., white,	20 "	337
Slate, black,	80 "	417
SS.,	62 "	479
Slate, black,	90 "	569
" white,	103 "	672
SS. (salt water),	30 "	702
Slate, white,	48 "	750
SS.,	40 "	790
Slate,	50 "	840
SS., Mountain sand,	260 "	1100
Slate,	29 "	1129
SS.,	31 "	1160
Slate,	62 "	1222
SS.,	22 "	1244
Slate,	80 "	1324
SS.,	40 "	1364
Slate,	24 "	1388
SS.,	12 "	1400
Slate and shells,	50 "	1450
SS.,	20 "	1470
Slate and shells,	85 "	1555
Red rock,	28 "	1583
Slate,	20 "	1603
Stray sand,	15 "	1618
Slate,	14 "	1632
SS.,	31 "	1663
Slate,	35 "	1698
Shell,	4 "	1702
Slate,	144 "	1846
Shell,	6 "	1852
Slate,	28 "	1880
SS., Fourth SS. or Gordon,	12 "	1892
Slate,	214 "	2106

Unproductive.

Adams Well (*No. 87*).

August 28, 1885.

No. 1, on Adams farm, Montour district, Moon township, Allegheny county. Owners and authority, Philadelphia Gas Co.

Well mouth above ocean, in feet (reported),			980
Conductor,	10 to	10	970
SS., gray,	10 "	20	960
Slate, white,	60 "	80	900
" blue,	50 "	130	850

SS., gray,	40 to	170	810
Slate, dark,	65 "	235	745
" gray,	40 "	275	705
SS., white,	100 "	375	605
Slate, black,	95 "	470	510
SS., gray,	15 "	485	495
Slate, black,	25 "	510	470
Coal,	6 "	516	464
Slate, black,	39 "	555	425
Limestone,	8 "	563	417
Slate, gray,	72 "	635	345
SS., gray,	30 "	665	315
Slate, black,	35 "	700	280
SS., white,	85 "	785	195
Slate, black,	55 "	840	140
SS., white,	100 "	940	+40
" gray,	155 "	1095	—115
Slate, blue,	45 "	1140	—160
SS., gray,	25 "	1165	—185
Slate, gray,	35 "	1200	—220
SS., gray,	45 "	1245	—265
Slate, black,	195 "	1440	—460
SS., gray,	40 "	1480	—500
Slate and shells,	140 "	1620	—640
Red rock,	20 "	1640	—660
SS., gray,	20 "	1660	—680
Slate, blue,	75 "	1735	—755
SS., Stray sand,	7 "	1742	—762
Slate, black,	36 "	1778	—798
SS. (oil),	4 "	1782	—802
Slate,	2 "	1784	—804
SS.,	6 "	1790	—810
Slate and shells,	30 "	1820	—840
SS.,	8 "	1828	—848
Slate and shells,	117 "	1945	—965
SS.,	15 "	1960	—980
Slate and shells,	13 "	1973	—993
?	94 "	2067	—1087

Reddle Well (No. 88).

August 13, 1886.

No. 1, on Reddle farm, Montour district, Moon (?) township, Allegheny county. Owners and authority, Philadelphia Gas Co.

Sand and shells and red rock,	130 to	130	
SS.,	82 "	212	
Slate,	30 "	242	
SS.,	154 "	396	
Slate,	15 "	411	

SS.,	75	to	486
Slate,	15	"	501
SS. and shells,	5	"	506
Slate,	60	"	566
SS.,	42	"	608
Slate,	20	"	628
Slate and shells,	147	"	775
SS.,	100	"	875
Slate,	20	"	895
SS.,	11	"	906
Slate,	50	"	956
Red rock,	8	"	964
SS.,	150	"	1114
Slate,	25	"	1139
SS.,	200	"	1339
Slate,	10	"	1349
SS.,	301	"	1650
" (salt water),	131	"	1781
Slate,	10	"	1791
SS.,	35	"	1826
Slate and shells,	14	"	1840
SS.,	60	"	1900
Slate,	25	"	1925
SS. (oil),	22	"	1947
Slate,	40	"	1987
Slate and shells,	40	"	2027
SS.,	30	"	2057
Slate and shells,	20	"	2077
SS. (gas),	17	"	2094
Slate,	7	"	2101

"The hole being full of oil, the record from 1947′ is not accurate."

Scott Well No. 1.

February 15, 1886.

No. 1, on John Scott farm, Montour district, Moon township, Allegheny county. Owners and authority, Philadelphia Gas Co.

Conductor,	10	to	10
Slate,	90	"	100
SS., white,	60	"	160
Slate, white,	230	"	390
SS., white,	25	"	415
Slate, black,	155	"	570
SS., white,	60	"	630
Slate,	140	"	770
SS.,	40	"	810
Slate, black,	30	"	840

SS., gray,	324 to	1164
Slate, white,	30 "	1194
SS., shelly,	226 "	1420
" white, hard,	150 "	1570
Slate and shells,	48 "	1618
SS., white (salt water),	30 "	1648
Slate, black,	46 "	1694
SS., black, fine,	37 "	1731
SS., white,	20 "	1751
SS., black, hard,	40 "	1791
Slate and shells,	40 "	1831
Slate,	14 "	1845
SS., white (oil),	9 "	1854
" and black,	68 "	1922
Slate and shells,	415 "	2337

Well shot with 100 quarts and abandoned.

Byrne Well.

1888.

Located on M. O. Byrne's farm, on Moon Run, about half a mile from its mouth, Robinson township, Allegheny county. Owners, Fort Pitt Gas Co. Authority, Gartland & Feeley, contractors, per T. J. Vandergrift.

Elevation about 5′ above RR. at Montour Run.

Conductor,	14 to	14
SS.,	20 "	34
Coal,	4 "	38
Slate and shells,	150 "	188
SS. (little slate at 209′),	49 "	237
Slate and shells,	203 "	440
SS.,	30 "	470
Slate and shells (salt water),	30 "	500
SS.,	80 "	580
Slate and shells,	50 "	630
SS.,	23 "	653
Slate,	22 "	675
SS., Big sand,	346 "	1021
Slate,	109 "	1130
SS.,	10 "	1140
Slate and shells,	30 "	1170
SS.,	15 "	1185
Slate,	5 "	1190
SS.,	40 "	1230
Slate,	95 "	1325
Red rock,	25 "	1350
Slate and shells,	37 "	1387
SS.,	133 "	1520
Slate,	40 "	1560

SS., white, hard,	20	to	1580
Slate,	10	"	1590
SS.,	20	"	1610
Shells,	10	"	1620
SS.,	25	"	1645
Slate,	10	"	1655
SS. (some oil at 1660′),	20	"	1675
Slate and shells,	7	"	1682
SS. (some black oil),	15	"	1697
Slate and shells,	10	"	1707
SS.,	20	"	1727
Slate,	12	"	1739
SS. (gas),	10	"	1749
Slate and shells, to bottom,	21	"	1770

Ewing Well.

1885.

Located on Schmidt farm, one mile above Ewing's mill, Robinson township, Allegheny county. Authority, T. J. Vandergrift.

? (gas at 675′),	675	to	675
SS., "Salt water sand," and slate,	60	"	735
? (salt water at 1520′, cased at 1560′),	825	"	1560
? (oil at 1580′),	20	"	1580
?	120	"	1700
SS., pebbly (gas at 1705′, slaty at 1718′),	65	"	1765
?	31	"	1796
SS., pebbly,	6	"	1802
" gray,	13	"	1815
?	88	"	1903
SS., pebbly,	19	"	1922
Slate, to bottom,	505	"	2427

Fife Well (No. 112).

July 9, 1887.

No. 2, on Fife farm, near Sodom, Bridgeville district, Upper St. Clair township, Allegheny county. Owners and authority, Philadelphia Gas Co.

Conductor,	9	to	9
Limestone, blue, hard,	135	"	144
Slate and shells, white, soft,	40	"	184
Limestone, blue, hard,	20	"	204
Slate, white,	16	"	220
Coal,	8	"	228
Clay, white,	5	"	233
Limestone, blue, hard,	30	"	263
Slate, white,	40	"	303

Red rock,	15	to	318
Slate, white,	48	"	366
Red rock, soft,	35	"	401
Red, pale, soft,	40	"	441
SS., white,	80	"	521
Slate, black,	50	"	571
Coal,	5	"	576
Slate, black,	80	"	656
Slate and shale, white,	50	"	706
Red rock,	35	"	741
Slate and shale,	30	"	771
SS., white, hard, close (salt water),	12	"	783
Coal (gas),	6	"	789
Slate and shells, black,	35	"	824
SS., white,	40	"	864
Slate, black,	45	"	909
SS., bluish,	20	"	929
Sand shale,	30	"	959
Slate, blackish,	15	"	974
SS., white,	12	"	986
Slate, blackish,	5	"	991
SS. and shells, bluish,	15	"	1006
" white,	35	"	1041
" " coarse, open,	25	"	1066
Slate, black,	18	"	1084
SS., white,	200	"	1284
Slate, black (1310′ of $5\frac{5}{8}$″ casing),	80	"	1364
SS., white,	318	"	1682
Slate shells, black,	182	"	1864
SS., white,	50	"	1914
Slate, black,	42	"	1956
Shale, bluish,	35	"	1991
Slate, black,	10	"	2001
SS., supposed to be Gantz,	15	"	2016
Slate,	90	"	2106
SS., white,	40	"	2146
" black,	10	"	2156
" Gas sand, pebbly (show of oil),	5	"	2161
" very inferior quality,	4	"	2165
" white, hard, close,	28	"	2193
Red rock,	10	"	2203
SS., gray,	16	"	2219
Slate, black,	40	"	2259
SS., white, Gordon,	21	"	2280
Red rock,	8	"	2288
Slate and shells, black,	$214\frac{1}{2}$	"	$2502\frac{1}{2}$

"Strong gasser. No salt water in this well."

Gilfillan Well (No. 118).

August 23, 1888.

No. 1, on Gilfillan farm, Bridgeville district, Upper St. Clair township, Allegheny county. Owners and authority, Philadelphia Gas Co.

Conductor,	10 to	10
SS.,	6 "	16
Slate,	8 "	24
Limestone,	20 "	44
SS., white,	12 "	56
Slate, white,	8 "	64
Limestone, white,	40 "	104
SS., blue,	15 "	119
Slate, white,	10 "	129
Limestone, blue,	30 "	159
Slate, black,	20 "	179
SS., white,	10 "	189
Limestone, white,	15 "	204
SS., white,	10 "	214
Slate, black,	7 "	221
Slate, white,	18 "	239
Limestone, white,	70 "	309
Slate, white,	10 "	319
Red rock,	20 "	339
Slate, white,	15 "	354
Red rock,	20 "	374
SS., white,	20 "	394
SS.,	30 "	424
Red rock,	20 "	444
Slate, white,	15 "	459
Red rock,	10 "	469
Slate, white,	30 "	499
Red rock, soft,	15 "	514
Slate, white,	20 "	534
Red rock,	15 "	549
Slate, white,	50 "	599
SS., white,	40 "	639
Slate, dark,	30 "	669
Slate, white,	60 "	729
Slate, dark,	25 "	754
SS., dark,	60 "	814
Slate, white,	75 "	889
Slate, black,	80 "	969
Coal (salt water),	8 "	977
Slate, white,	90 "	1067
Slate, black,	50 "	1117
Slate, white,	14 "	1131
SS., white,	56 "	1187
SS., black (gas),	10 "	1197

SS., white,	84 to	1281
Slate, white,	40 "	1321
Slate, black,	30 "	1351
SS., yellow,	80 "	1431
SS., dark,	100 "	1531
Slate, white,	6 "	1537
SS., white,	60 "	1597
Slate, white,	80 "	1677
SS., white,	191 "	1868
Slate, white,	40 "	1908
SS., white,	30 "	1938
Slate, white,	40 "	1978
?	125 "	2103
SS., white, Gantz sand,	30 "	2133
Slate, black,	7 "	2140
SS., pebbly (gas),	10 "	2150
SS., white,	5 "	2155
Slate, white,	2 "	2157
SS., white,	36 "	2193
Slate, white,	2 "	2195
SS., dark,	7 "	2202
Slate, black,	4 "	2206
SS., dark,	14 "	2220
Slate and shells, black,	10 "	2230
Red rock,	10 "	2240
Slate, black,	10 "	2250
Gordon stray,	20 "	2270
Slate, black,	28 "	2298
SS., Gordon,	2 "	2300
Slate, black,	55 "	2355
Shell,	5 "	2360
Slate, red,	5 "	2365
Shale, blue,	15 "	2380
Shell, dark,	5 "	2385
Slate, black,	5 "	2390
Slate, red,	10 "	2400
SS., white,	10 "	2410
Shale, black,	10 "	2420
Shale, blue,	22 "	2442

Alexander Well.

1886.

Located near Bridgeville, Allegheny county. Owner, C. D. Robbins. Authority, T. J. Vandergrift.

?	30 to	30
Coal, Pittsburgh, say	5 "	35
?	1895 "	1930
SS., 5′ of good sand (oil and water), say	15 "	1945
?	255 "	2200
SS., "no good," say	10 "	2210
? to bottom,	40 "	2250

Trumbull Well.

1888.

Located on the Trumbull farm, near Sodom, Upper St. Clair township, Allegheny county. Owners, the Manufacturers' Gas Co. Authority, W. M. Graham.

Conductor,	12 to 12
?	118 " 130
Coal, say,	5 " 135
? (160′ of 10″ casing and 1100′ of 5½″)	1880 " 2015
SS., "Gantz," top poor, estimated,	20 " 2035
?	25 " 2060
SS., "Fifty foot," top good, pebbly, (gas,)	37 " 2097
?	113 " 2210
SS., Stray, estimated,	15 " 2225
? to bottom,	50 " 2275

Robbins Well.

November, 1886.

Located on J. Campbell farm, South Fayette township, Allegheny county. Authority, Mr. Robbins, per T. J. Vandergrift.

?	1910 to 1910
SS., "Fifty-foot rock,"	50 " 1960
Slate, soft,	90 " 2050
Slate and pebbles,	6 " 2056
Slate,	39 " 2095
Red rock,	15 " 2110
SS., stray,	30 " 2140

"At this depth the well made several strong flows of oil."

Cochran Well (No. 96).

December 17, 1886.

No. 1, at Cochran's mills, southeasterly part of Snowden township, Allegheny county. Owners and authority, Philadelphia Gas Co.

? (conductor 20′, 193′ of 10″ casing),	213 to 213
Coal (gas),	2 " 215
Slate, white,	58 " 273
SS., white,	20 " 293
Slate, white,	15 " 308
SS., white,	18 " 326
Slate, black,	26 " 352

SS., black (salt water),	56	to	408
Slate, black,	160	"	568
" and shells, gray,	10	"	578
SS., gray,	15	"	593
Slate, black (615′ of 7⅝″ casing),	30	"	623
SS., white,	70	"	693
Slate, black,	60	"	753
SS., white,	60	"	813
Slate, black (little gas),	35	"	848
SS., white, Gas sand,	55	"	903
Slate, black,	135	"	1038
SS., gray (salt water),	5	"	1043
Slate, black (1090′ of 5⅝″ casing),	5	"	1048
" and shells, white,	75	"	1123
SS., white,	285	"	1408
Slate and shells, white,	110	"	1518
SS., gray,	25	"	1543
Slate and shells, white,	320	"	1863
SS., gray,	20	"	1883
Slate and shells, white,	20	"	1903
SS., gray,	50	"	1953
Slate and shells, black,	10	"	1963
SS., white,	25	"	1988
Slate, black,	30	"	2018
SS., white and gray,	50	"	2068
Red rock,	5	"	2073
SS., blue,	5	"	2078
Slate and shells, black,	35	"	2113
Slate and SS., blue,	10	"	2123
Red rock,	10	"	2133
Slate, black,	10	"	2143
Red rock,	25	"	2168
SS., white,	20	"	2188
Slate and shells, white,	60	"	2248
" " black,	25	"	2273
Red rock,	15	"	2288
Slate, white, to bottom,	60	"	2348

Gasser. Packer 175′ from the bottom. For record of Wallace Station well, three-fourths of a mile north of Cochran's mill, see report of 1886, page 752.

Westinghouse Well No. 1.

May 31, 1884.

Located on the grounds of Mr. Geo. Westinghouse, Jr., between Martland and Lang avenues, in 21st ward, Pittsburgh. Authority, Philadelphia Gas Co.

Well mouth above ocean, in feet,			940
Clay, yellow,	8	to 8	932

SS., gray,	22 to	30	910
Slate, blue,	10 "	40	900
SS., gray,	30 "	70	870
Slate, gray,	30 "	100	840
SS., blue,	20 "	120	820
Slate, gray,	5 "	125	815
" red,	35 "	160	780
" gray,	25 "	185	755
" red,	15 "	200	740
" blue,	60 "	260	680
SS., gray,	12 "	272	668
Slate, red,	65 "	337	603
SS., gray,	38 "	375	565
" white,	84 "	459	481
Slate, black,	41 "	500	440
SS., white,	30 "	530	410
Slate, black,	20 "	550	390
SS., white,	20 "	570	370
Slate, black,	10 "	580	360
SS., gray (gas),	10 "	590	350
Slate, gray,	35 "	625	315
Coal,	3 "	628	312
Slate, black,	27 "	655	285
SS., white,	33 "	688	252
Slate, black,	22 "	710	230
SS., gray,	15 "	725	215
Slate, gray,	10 "	735	205
SS., white (salt water 865′, gas 868′),	167 "	902	+38
Slate, black,	70 "	972	—32
SS., white,	98 "	1070	—130
" black,	66 "	1136	—196
" gray,	134 "	1270	—330
Slate, gray,	30 "	1300	—360
SS., gray,	130 "	1430	—490
Slate and shells, black,	140 "	1570	—630
SS., pebbly (gas very strong),	5 "	1575	—635

Westinghouse Well No. 3.

October, 1884.

Located in Mr. Card's yard, at Homewood, 21st ward, Pittsburgh. Authority, Philadelphia Gas Co.

Well mouth above ocean in feet,			975
Clay,	4 to	4	971
SS.,	50 "	54	921
Slate, gray,	30 "	84	891
" blue,	5 "	89	886
" gray,	21 "	110	865
" red,	30 "	140	835
" gray,	5 "	145	830

SS., gray,	30	to	175	800
" blue,	6	"	181	794
Slate, gray,	25	"	206	769
" red,	25	"	231	744
" blue,	49	"	280	695
" black,	60	"	340	635
" blue,	15	"	355	620
" red,	15	"	370	605
" gray,	55	"	425	550
SS., gray,	40	"	465	510
Slate, brown,	50	"	515	460
" white,	5	"	520	455
SS., black,	10	"	530	445
Coal,	2	"	532	443
Slate, white,	6	"	538	437
SS., gray,	15	"	553	422
Slate,	40	"	593	382
SS., black,	30	"	623	352
" gray,	15	"	638	337
Slate, black,	50	"	688	287
SS., gray,	30	"	718	257
" white,	45	"	763	212
" black,	80	"	843	132
" white,	20	"	863	112
" "	50	"	913	62
" soft and white,	10	"	923	+52
" black,	100	"	1023	—48
" white,	125	"	1148	—173
Slate, brown,	20	"	1168	—193
SS., gray,	145	"	1313	—338
Slate, gray,	50	"	1363	—388
" black,	86	"	1449	—474
" and shale,	10	"	1459	—484
Pebble sand, white,	14	"	1473	—498
SS., gray,	15	"	1488	—513
SS. to bottom,	147	"	1635	—660

Westinghouse Deep Well.

1884–1886.

Located in 21st ward, Pittsburgh (Homewood), on northeasterly corner of Lang avenue and Grazier street. This well was originally known as the Dillworth well and was drilled by the McCalmont Oil Company in the fall of 1884, to the depth of 1535 feet. In 1885 and 1886 it was deepened by Mr. Westinghouse to 4618 feet, where the cable parted, the tools dropped in the hole and there they still remain. The first 1535′ of the record was given to the McCalmont Oil Company by Wm. C. Marr, contractor. From that

point to about 3600′, no record seems to have been kept by the drillers, except that there was a white pebbly sandstone at 2135 feet and a brownish oily sand at 2966′. From 3600′ to the bottom, specimens from nearly every bit were preserved, as indicated in the record below. It is greatly to be regretted that a complete suite of specimens was not preserved from top to bottom of this the deepest well in the State.

Well mouth above ocean in feet,			885
Conductor,	16 to	16	869
Slate,	30 "	46	839
" with shells,	10 "	56	829
Limestone,	146 "	202	683
Slate and shale,	100 "	302	583
SS., close and hard,	30 "	332	553
Slate and shale,	68 "	400	485
" black,	30 "	430	455
SS., hard and close,	100 "	530	355
Slate, with shells,	50 "	580	305
Coal,	12 "	592	293
Shells, and small coal seams,	33 "	625	260
SS., close and hard,	15 "	640	245
Slate and hard shales,	110 "	750	135
SS., hard (salt water at bottom),	85 "	835	+50
Slate and shales (cased at 840′),	95 "	930	—45
SS., very hard and close,	490 "	1420	—535
Slate,	40 "	1460	—575
" with shell,	25 "	1485	—600
SS., close and hard,	25 "	1510	—625
Slate and shale, hard,	25 "	1535	—650
SS., Gas sand, estimated,	30 "	1565	—680
? (place of Butler group),	570 "	2135	—1250
SS., pebbly, estimated (specimen No. 2),	10 "	2145	—1260
Slate,	821 "	2966	—2081
" sandy, brownish, micaceous (Specimen No. 3),	20 "	2986	—2101
"	614 "	3600	—2715
" common (Specimens 4–30),	345 "	3945	—3060
" sandy, some lime (" 31),	5 "	3950	—3065
" common (" 32–39),	100 "	4050	—3165
" sandy, some lime (" 40),	5 "	4055	—3170
" common (" 41–43),	45 "	4100	—3215
" sandy, some lime (" 44),	5 "	4105	—3220
" common (" 45–57),	160 "	4265	—3380
" and fine sand (" 58),	5 "	4270	—3385
" gritty (" 59–60),	35 "	4305	—3420
" sandy, some lime (" 61),	5 "	4310	—3425
" common (" 62–87),	308 "	4618	—3733

Unproductive.

Chapter XVIII.

New Well Records in Washington County.

Gabby Well No. 1.

October, 1885.

On W. Gabby farm, Franklin township, Washington county. Owners, Pew & Emmerson. Authority, company's record book.

?	475 to	475
Coal, Pittsburgh,	5 "	480
? (little gas at 896′),	502 "	982
SS., gray (oil show),	10 "	992
? (1420′ of $5\frac{5}{8}$″ casing, salt water 1700′),	1302 "	2294
SS. (oil and gas, hole filled up 800′),	21 "	2315
Slate,	19 "	2334
SS., rather fine,	4 "	2338
Slate,	12 "	2350
SS., coarse, 6 " close, 124	130 "	2480
Slate,	20 "	2500
SS., 2′ pebbly, 46′ fine, "Gordon stray,"	48 "	2548
" "Gordon,"	21 "	2569
Slate,	5 "	2574
SS., clover seed, poor, dark,	21 "	2595
Slate, to bottom,	13 "	2608

Abandoned.

Weirich Well.

1888.

Located on the J. K. Weirich farm, Canton township, Washington county. Authority, T. J. Vandergrift.

?	525 to	525
Coal, Pittsburgh, say	5 "	530
? (caved at 820′, 850′ of $7\frac{5}{8}$″ casing),	430 "	960
Some gas at (950′ of $6\frac{1}{4}$″ casing),		960
?	475 "	1435
More gas at		1435
?	65 "	1500
Cave and salt water at		1500
? (1639′ of 5″ casing),	835 "	2335

SS., "Gantz," estimated,	30 to	2365
?	167 "	2532
SS., "Stray," estimated,	25 "	2557
?	41 "	2598
SS, "Gordon" (salt water at 2610′),	37 "	2635
Slate,	20 "	2655
SS.,	36 "	2691
Slate, to bottom,	36 "	2727

Wylie Well No. 4.

April, 1886.

Located on the Wylie farm, South Strabane township, Washington county. Owners, People's Natural Gas Co. Authority, the company's record book.

? (salt water 1160′, cased 1197′),	2037 to	2037
SS., "Gantz," some gas, estimated,	20 "	2057
Slate, SS., (gas at 2100′),	103 "	2160
Slate,	100 "	2260
Red rock,	15 "	2275
Slate,	5 "	2280
Red rock,	5 "	2285
SS., white,	5 "	2290
" and slate,	10 "	2300
" white,	30 "	2330
Slate,	80 "	2410

Kountz Well No. 5.

May, 1886.

Located on the farm of J. W. Kountz, South Strabane township, Washington county. Owners, The People's Natural Gas Co. Authority, company's record book.

?	420 to	420
Coal,	6 "	426
? (1380′ of $5\frac{5}{8}$″ casing),	1754 "	2180
SS., "Gantz,"	104 "	2284
Slate,	81 "	2365
Red rock,	10 "	2375
SS. and slate,	10 "	2385
Slate,	16 "	2401
SS. Stray (little oil at 2456′),	60 "	2461
Slate,	19 "	2480
SS.,	20 "	2500
Slate, to bottom,	3 "	2503

Well levels in the Washington Field.

Taken for the Union Oil Company by their engineer.

Gordon Well No. 1,	Gordon farm (base of levels),	. .	1012	A. T.
Dyer & Co.	No. 1, McGahey farm,	. . .	1115	"
Munhall & Smithman	" 1, R. D. Wylie "	. . .	1204	"
Pew & Emerson	" 1, Manifold "	. . .	1042	"
" "	" 1, Miller "	. . .	1102	"
Vandergrift	" 1, Barry "	. . .	1079	"
Dyer & Co.	" 1, Smith "	. . .	1059	"
Craig & Co.	" 1, Cameron "	. . .	1114	"
" "	" 2, " "	. . .	1142	"
Gallighan	" 1, Taylor "	. . .	1153	"
Union Oil Co.	" 1, " "	. . .	1159	"
" "	" 3, " "	. . .	1325	"
Willetts	" 2, Munce "	. . .	1160	"
"	" 3, " "	. . .	1110	"
"	" 4, " "	. . .	1137	"
"	" 5, " "	. . .	1074	"
"	" 6, " "	. . .	1193	"
Pew & Emerson	" 1, Kountz "	. . .	1252	"
" "	" 2, " "	. . .	1174	"
McKeown	" 1, Munce "	. . .	1345	"

Canonsburg Wells.

Records of wells Nos. 200, 203, 212, 215, 216, 221, 218, 220, 222, 223, 224, 225, 226 and 230, belonging to the Philadelphia Gas Co. and located in the Canonsburg district in Cecil, Chartiers and North Strabane townships, Washington county. The records were copied from the company's books, and having been kept in detail by the several contractors who were employed, present an interesting study of the stratigraphical variations in this important district as noted by them. It is to be regretted, however, that the mountain limestone has been entirely ignored, and that no well-mouth altitudes have been obtained.

*Arnold Well (No. 200).**

August 15, 1886.

No. 1, on Arnold farm, Canonsburg district. Deepened September, 1887.

* Throughout this report, these numbers enclosed in brackets are the running well-numbers from the books of the Philadelphia Gas Co.

Commenced to deepen at		1825
SS., gray,	12 to	1837
" white,	6 "	1843
" gray,	2 "	1845
" hard,	6 "	1851
" black,	4 "	1855
" gray,	2 "	1857
" white, bottom of Fifty-foot,	4 "	1861
Slate and shale,	9 "	1870
" (gas in slate),	20 "	1890
SS., gray,	45 "	1935
Red rock,	4 "	1939
SS., gray,	5 "	1944
Red rock,	3 "	1947
SS., gray,	10 "	1957
Slate and shale,	30 "	1987
SS., dark gray, top of Gordon sand,	5 "	1992
Slate,	4 "	1996
SS., red,	3 "	1999
SS., white, pebbly (gas),	6 "	2005
" gray,	4 "	2009
" white,	13 "	2022
Slate, white,	1 "	2023
SS., white, good sand,	5 "	2028
" gray,	4 "	2032
" " pebbly,	5 "	2037
" dark-gray, bottom of Gordon,	13 "	2050
Slate, black to bottom,	4 "	2054

Houston Well (*No. 203*).

November 13, 1885.

No. 1, on Houston farm, Canonsburg. Deepened October 20, 1887.

Commenced to deepen at		1765
SS., white,	18 to	1783
" gray,	2 "	1785
" black,	15 "	1800
Slate and shale,	60 "	1860
SS., red,	5 "	1865
Slate, black,	15 "	1880
" and shale,	20 "	1900
" black,	30 "	1930
SS., gray, "Stray,"	5 "	1935
" red and gray,	6 "	1941
" white,	25 "	1966
Break between Stray and Gordon,	2 "	1968
SS., gray, pebbles (gas),	10 "	1978
" white (more gas),	10 "	1988
" gray, hard,	4 "	1992
" " soft,	2 "	1994
Slate, black, to bottom,	4 "	1998

Boyce Well (No. 212).

September 10, 1887.

No. 2, on Boyce farm, Canonsburg district.

Clay,	19 to	19
Coal,	6 "	25
Limestone, blue,	20 "	45
Slate, white,	45 "	90
" red,	36 "	126
" black,	9 "	135
Shale, red,	47 "	182
SS., gray,	10 "	192
Slate, black,	20 "	212
SS., gray (salt water),	38 "	250
Shale, red,	25 "	275
Slate, black,	5 "	280
SS., gray,	20 "	300
Slate, white,	10 "	310
SS., gray,	20 "	330
Slate, black,	15 "	345
SS., gray,	10 "	355
Slate, black,	25 "	380
SS., gray,	5 "	385
Slate, black,	10 "	395
SS., gray,	20 "	415
Slate and shells,	25 "	440
Slate, black,	40 "	480
" very black, with coal,	15 "	495
Shells, gray (little gas),	2 "	497
Slate, black,	40 "	537
SS., white,	45 "	582
Slate, black, with coal,	5 "	587
" white,	10 "	597
SS., white,	53 "	650
Slate, black,	15 "	665
SS., white,	25 "	690
" black, with coal (salt water),	3 "	693
" white,	25 "	718
Slate, white,	7 "	725
SS., gray and white (little gas),	115 "	840
Slate and shells,	132 "	972
SS., white and gray (little gas),	60 "	1032
Slate, black,	40 "	1072
SS., white,	35 "	1107
Slate, black,	13 "	1120
SS., white, Big Injun (gas),	240 "	1360
Slate and shells, black,	20 "	1380
SS., white,	50 "	1430
Slate, black,	70 "	1500
" and shells, black,	75 "	1575
SS., white,	50 "	1625

Slate and shells, black,	35 to 1660
SS., gray,	80 " 1740
Slate and shells, black,	66 " 1806
SS., gray, Gantz sand (much gas),	15 " 1821

Stiles Well (No. 215).

December 5, 1887.

No. 2, on Stiles farm, Canonsburg district.

Lime, gray,	30 to 30
Slate, red,	8 " 38
" green,	14 " 52
" black,	60 " 112
SS., gray,	13 " 125
Slate, gray,	30 " 155
SS., gray,	70 " 225
" red,	7 " 232
Lime, blue,	13 " 245
Red rock,	45 " 290
Slate, black,	60 " 350
" green,	35 " 385
Red rock,	10 " 395
Slate, black,	120 " 515
SS., gray,	15 " 530
Slate, black,	65 " 595
" gray,	10 " 605
" black,	20 " 625
SS., gray,	30 " 655
Slate, black,	105 " 760
SS., gray,	40 " 800
Slate, black,	10 " 810
SS., gray,	55 " 865
Slate, black,	20 " 885
SS., gray,	75 " 960
Slate, black,	35 " 995
SS., gray,	45 " 1040
Slate, black,	50 " 1090
SS., light and gray,	360 " 1450
Slate, black,	170 " 1620
" and shells,	80 " 1700
" gray,	60 " 1760
SS., gray, Gantz and Fifty-foot (gas at 1764'),	100 " 1860
Slate, gray,	120 " 1980
SS., gray, Stray,	40 " 2020
" " Gordon,	18 " 2038
Slate, black,	25 " 2063
SS., dark, 4th SS. (no gas),	37 " 2100
Slate, white, to bottom,	35 " 2135

Little Well (No. 216).

October 27, 1887.

No. 1, on Little farm, Canonsburg district.

Clay,	11 to	11
Lime,	4 "	15
Slate, red,	5 "	20
Lime,	3 "	23
Slate,	10 "	33
Lime,	30 "	63
Slate, red (cave),	40 "	103
SS., gray,	5 "	108
Slate, red,	35 "	143
" blue,	10 "	153
SS., blue,	25 "	178
Slate, light,	5 "	183
" red (cave),	10 "	193
SS., blue,	15 "	208
Slate, light (247$\frac{10}{12}$′ of 8$\frac{1}{4}$″ casing),	40 "	248
" red,	20 "	268
" and shells, light,	30 "	298
SS., gray,	30 "	328
" blue,	25 "	353
Slate, light,	40 "	393
" black,	80 "	473
" light,	25 "	498
" pink,	12 "	510
SS., white, hard,	40 "	550
Slate and shells, white, soft,	40 "	590
SS., gray (salt water at 630′),	50 "	640
Lime, brown,	15 "	655
SS., white,	10 "	665
" black,	10 "	675
Slate, black,	35 "	710
Slate and shell,	15 "	725
SS., white,	15 "	740
SS., gray,	40 "	780
Slate, light (gas at 788′),	10 "	790
Lime, brown,	5 "	795
SS., gray,	8 "	803
Slate, dark,	35 "	838
" light,	18 "	856
" black,	30 "	886
" light,	18 "	904
SS., white,	80 "	984
Slate, black (100$\frac{1}{2}$′ of 6″ casing),	30 "	1014
SS., white,	30 "	1044
Slate, black,	45 "	1089
SS., black,	10 "	1099
" white,	104 "	1203
" black,	4 "	1207

SS., white,	70 to	1277
" gray,	20 "	1297
Slate, light,	40 "	1337
" and shells, light,	20 "	1357
SS., gray,	50 "	1407
Slate and shells,	55 "	1462
" light,	36 "	1498
SS., dark,	18 "	1516
" gray,	60 "	1576
Slate and shells,	43 "	1619
SS., blue,	25 "	1644
Slate and shells (1677 of 4" casing),	40 "	1684
" light,	62 "	1746
SS., light, Gantz sand (1st flow of gas),	6 "	1752
" white (large flow of gas),	11 "	1763

Little Well (No. 221).

February 8, 1888.

No. 2, on Little farm, Canonsburg district.

Soil,	14 to	14
Slate,	6 "	20
Lime, white,	4 "	24
Slate, white,	8 "	32
Lime, white,	3 "	35
Slate, white,	8 "	43
SS., white,	4 "	47
Slate, white,	20 "	67
" red,	30 "	97
Lime, white,	8 "	105
Red rock, soft,	41 "	146
Slate, red,	50 "	196
SS., white,	10 "	206
Slate, white,	30 "	236
" red,	10 "	246
" black,	15 "	261
" white,	40 "	301
" red,	20 "	321
SS., white,	100 "	421
Slate, white,	40 "	461
SS., white,	30 "	491
Slate, black,	14 "	505
SS., black,	50 "	555
" white,	90 "	645
Slate, white,	30 "	675
SS., white,	45 "	720
Lime, white,	20 "	740
Soapstone, black,	6 "	746
Coal,	4 "	750
SS., white and gray (gas at top),	135 "	885

Slate, white,	10 to	895
SS., black,	5 "	900
Slate, black,	50 "	950
SS., white,	50 "	1000
" black,	23 "	1023
Slate, black,	30 "	1053
SS., black,	25 "	1078
Slate, black,	32 "	1110
SS., black, "Manifold sand,"	40 "	1150
" white and gray,	278 "	1428
Slate, white,	50 "	1478
SS., gray,	15 "	1493
Slate, white,	90 "	1583
" and shells, gray,	25 "	1608
" black,	40 "	1648
SS., black,	25 "	1673
Slate and shells, black,	45 "	1718
" white,	68 "	1786
SS., gray, Gantz sand (gas),	24 "	1810
Slate, white,	6 "	1816
SS., gray, 50′ rock (gas),	53 "	1869
Slate, gray, soft,	60 "	1929
SS., gray, hard,	15 "	1944
Slate, black, soft,	48 "	1992
SS., Gordon stray (large gas),	48 "	2040
Slate, to bottom,	18 "	2058

Cook Well (*No. 218*).

February 2, 1888.

No. 1, on Cook farm, Canonsburg district.

Surface,	15 to	15
Limestone, gray,	20 "	35
Slate, black,	5 "	40
Coal,	2 "	42
Limestone, white,	25 "	67
Rock, blue,	15 "	82
Limestone, light,	5 "	87
Soft rock, blue and red,	64 "	151
SS., gray,	10 "	161
Slate, dark,	20 "	181
Red rock,	24 "	205
Lime, light,	8 "	213
Slate, light,	12 "	225
Red rock, soft,	30 "	255
Limestone, gray,	3 "	258
Red rock,	58 "	316
Slate, dark,	46 "	362
SS., gray,	10 "	372
Slate,	97 "	469
SS., gray,	43 "	512

Slate, light,	73 to	585
Red rock,	10 "	595
Slate, black,	15 "	610
SS., dark,	12 "	622
Slate, white,	35 "	657
SS., light,	22 "	679
Slate, black,	37 "	716
SS., black,	5 "	721
Slate, black,	20 "	741
Sand shells, black,	2 "	743
Slate, black,	12 "	755
Shell, black,	3 "	758
Slate, black,	20 "	778
Sand shells,	2 "	780
Slate, light,	12 "	792
Shell,	3 "	795
Slate, black,	20 "	815
" and shells,	81 "	896
SS., black,	5 "	901
" white,	55 "	956
Slate, dark,	25 "	981
SS., white,	35 "	1016
Slate, dark,	45 "	1061
SS., white and gray,	223 "	1284
Slate, light,	50 "	1334
SS., white,	30 "	1364
Slate and shells,	30 "	1394
SS., white,	35 "	1429
Slate, light,	75 "	1504
SS., gray,	20 "	1524
Slate, light,	15 "	1539
SS., gray,	30 "	1569
Slate, light,	15 "	1584
SS., hard,	30 "	1614
Slate, light,	6 "	1620
SS., gray,	20 "	1640
Slate, light,	6 "	1646
SS., gray,	15 "	1661
Slate, light, shelly,	65 "	1726
SS., brown,	26 "	1752
Slate, light,	11 "	1763
SS., white, Gantz sand, close (no gas),	28 "	1791
Slate,	3 "	1794
SS., gray, pebbles, Fifty foot (gas),	63 "	1857
Slate, light,	70 "	1927
SS., red, hard,	26 "	1953
Slate, light,	36 "	1989
SS., gray, Stray sand (no gas),	42 "	2031
" and white, Gordon SS. (gas),	24 "	2055
Slate, white, shelly,	35 "	2090
SS., blue, Hickory SS. (no gas),	22 "	2112
Slate, light,	40 "	2152

Sand and lime, brown, very hard,	10 to	2162
Slate, light, shelly,	13 "	2175
SS., gray, dark,	24 "	2199
Slate, light,	31 "	2230
" and shells, to bottom,	228 "	2458

Brady Well (No. 220).

February 2, 1888.

No. 3, on Brady farm, Canonsburg district.

Clay,	14 to	14
Slate, white,	10 "	24
Lime, gray,	11 "	35
Coal,	5 "	40
Lime, gray,	30 "	70
Slate, white,	40 "	110
SS., dark,	90 "	200
Slate, red,	30 "	230
" white,	60 "	290
Red rock,	80 "	370
Slate, white,	120 "	490
SS., white,	60 "	550
Slate, black,	40 "	590
SS., white,	30 "	620
Slate, black,	80 "	700
Slate and shells,	45 "	745
Slate, dark,	60 "	805
" white,	55 "	860
SS., dark,	15 "	875
Slate, black,	50 "	925
SS., white,	25 "	950
Coal, black,	5 "	955
Slate and shells,	15 "	970
SS., white,	75 "	1045
Slate, black,	25 "	1070
SS., white,	50 "	1120
Slate, dark,	30 "	1150
SS., white,	165 "	1315
SS., dark,	35 "	1350
" white,	50 "	1400
Slate, white,	100 "	1500
" and shells,	90 "	1590
" gray,	60 "	1650
SS., dark,	55 "	1705
Slate, white,	35 "	1740
SS., white, hard,—30′ rock (no gas),	32 "	1772
Slate, gray,	68 "	1840
SS., white, hard, Gantz SS.,	32 "	1872
Slate, white,	10 "	1882
SS., white, hard,—50′ rock,	42 "	1924

Slate, white,	60 to	1984
SS., red,	18 "	2002
Slate, black,	46 "	2048
SS., white, Stray,	39 "	2087
SS., white, Gordon (small flow of gas),	32 "	2119
Slate, black,	28 "	2147
SS., black, hard, Hickory SS.,	23 "	2170
Slate, black, to bottom,	6 "	2176

Scott Well (No. 222).

April 13, 1888.

No. 1, on R. D. Scott farm, Canonsburg district.

Clay,	11 to	11
Lime, blue,	49 "	60
Coal,	3 "	63
Lime, blue,	52 "	115
Slate, black,	5 "	120
Lime, blue,	20 "	140
SS., gray,	3 "	143
Lime, blue,	22 "	165
Slate, black,	47 "	212
Coal,	6 "	218
Lime,	52 "	270
Slate, black,	20 "	290
" red,	80 "	370
" black (377′ of $8\frac{1}{4}$″ casing),	10 "	380
SS., gray,	35 "	415
Slate, black,	35 "	450
Shale, red,	15 "	465
Slate, black,	135 "	600
SS., white,	20 "	620
Slate, black,	60 "	680
SS., white,	20 "	700
Slate, black,	15 "	715
SS., gray,	85 "	800
Slate, black,	20 "	820
SS., gray,	40 "	860
Slate, black,	20 "	880
Coal,	4 "	884
Slate, black,	5 "	889
SS., gray,	15 "	904
Slate, black,	20 "	924
SS., white,	40 "	964
Slate, black,	30 "	994
SS., gray,	26 "	1020
Slate, black,	30 "	1050
SS., white,	65 "	1115
Slate, black,	20 "	1135
SS., white,	80 "	1215
Slate, black (1220′ of 6″ casing),	10 "	1225

SS., white and gray, Big Injun,	75 to	1300
Slate, black,	10 "	1310
Lime, blue,	25 "	1335
SS., white, Big Injun (1517′ of $4\frac{1}{4}$″ casing),	240 "	1575
Slate, black,	20 "	1595
SS., white,	50 "	1645
Slate, black,	15 "	1660
SS., gray,	30 "	1690
Slate, black,	90 "	1780
SS., gray,	50 "	1830
Slate, black,	30 "	1860
SS., gray,	115 "	1975
Slate, white,	82 "	2057
SS., black, Gantz SS.,	5 "	2062
Slate, black,	18 "	2080
SS., white, 50′ rock (little gas),	25 "	2105
Shale, red,	5 "	2110
SS., gray,	12 "	2122
Slate and shells, black,	78 "	2200
SS., gray,	30 "	2230
Slate, black,	24 "	2254
SS., gray, Stray,	11 "	2265
Slate, black,	8 "	2273
SS., gray, Gordon SS.,	17 "	2290
Slate, black,	2 "	2292
SS., red,	12 "	2304
SS., gray, Gordon,	16 "	2320
Slate, black,	20 "	2340
SS., gray, Hickory SS.,	20 "	2360
Slate, black,	30 "	2390
Shells, dark,	29 "	2419
SS., gray, 100′ rock,	10 "	2429
Slate and shells, black, to bottom,	73 "	2502

Unproductive.

Haggarty Well (No. 223).

March 17, 1888.

No. 2, on A. N. Haggarty farm, Canonsburg district.

Clay,	14 to	14
Limestone, gray,	20 "	34
" white,	30 "	64
Slate, white,	20 "	84
Limestone, white,	20 "	104
Slate, black,	10 "	114
Limestone, blue,	25 "	139
SS., blue,	15 "	154
Slate, red,	45 "	199
Limestone, brown,	6 "	205
Slate, blue,	33 "	238
SS., blue and gray,	21 "	259

Slate, red,	20 to	279
" blue,	18 "	297
SS., gray,	13 "	310
Slate, black,	75 "	385
SS., blue,	20 "	405
Slate, black,	18 "	423
SS., white,	51 "	474
Slate, red,	46 "	520
SS., gray,	25 "	545
Slate, white,	103 "	648
SS., gray,	15 "	663
Slate and shale, dark,	45 "	708
Slate, light,	38 "	746
SS., gray (gas and water at 780′),	34 "	780
Coal,	3 "	783
SS., gray,	20 "	803
Slate, dark and gray,	102 "	905
SS., white,	40 "	945
Slate, black (gas and water at 915′),	10 "	955
SS., black,	12 "	967
Slate (gas and salt water at 1012′),	75 "	1042
SS., gray and white,	108 "	1150
Slate, white and black,	65 "	1215
SS., black, white, blue, Big Injun,	220 "	1435
Slate, gray,	60 "	1495
SS., white,	20 "	1515
Slate and shells, white,	30 "	1545
SS., gray,	40 "	1585
Slate, light,	19 "	1604
Slate and shells,	58 "	1662
" dark and light,	53 "	1715
SS., light and blue,	26 "	1741
Slate, dark,	10 "	1751
" and shells, dark,	9 "	1760
SS., gray, Thirty-foot,	30 "	1790
Slate, white,	12 "	1802
" and shells, white,	20 "	1822
SS., blue,	13 "	1835
Slate, white,	20 "	1855
" and shells, white,	18 "	1873
" black,	36 "	1909
SS., white, Gantz sand,	23 "	1932
Slate, white,	23 "	1955
SS., white, Fifty-foot,	30 "	1985

Caltergahn Well (No. 224).

January 11, 1888.

No. 1, on Caltergahn farm, Canonsburg district.

Conductor,	14 to	14
Slate, black,	2 "	16

Limestone, gray,	40 to	56
Slate, white,	9 "	65
Limestone, white,	5 "	70
SS., gray,	10 "	80
Coal,	5 "	85
Slate, black,	10 "	95
Limestone, gray,	8 "	103
Slate, white,	7 "	110
Coal,	6 "	116
Limestone, gray,	10 "	126
Red rock,	4 "	130
Limestone, white,	12 "	142
Slate, black,	30 "	172
Limestone, dark,	25 "	197
Slate, red,	75 "	272
" white,	25 "	297
SS., gray,	11 "	308
Slate, red,	50 "	358
" white,	35 "	393
" red,	50 "	443
" white,	55 "	498
SS., gray,	28 "	526
Slate, dark,	50 "	576
" white,	104 "	680
Coal,	4 "	684
Limestone, white,	20 "	704
SS., dark,	15 "	719
Coal (gas),	5 "	724
Slate, white,	4 "	728
Limestone, dark,	12 "	740
Slate, black,	10 "	750
SS., gray,	15 "	765
Coal (gas),	5 "	770
Shale, black,	78 "	848
Slate, white (gas and water at 858'),	10 "	858
SS., gray,	40 "	898
Slate, dark,	30 "	928
SS., gray,	50 "	978
Slate, dark,	20 "	998
SS., white and gray (gas and salt water at top,)	153 "	1151
Slate, black,	103 "	1254
SS., white and dark, Big Injun,	212 "	1466
Slate, white,	145 "	1611
" dark,	161 "	1772
SS., white and gray, Thirty-foot,	57 "	1829
Slate, white,	35 "	1864
SS., white, and shells,	42 "	1906
" dark, Gantz,	12 "	1918
Slate, dark (small gas),	19 "	1937
SS., Fifty-foot,	36 "	1973
Slate, dark and shelly,	122 "	2095
SS., dark,	2 "	2097

SS., white, pebbles,	22 to	2119
" gray, Stray,	13 "	2132
Slate, dark,	1 "	2133
SS., yellow pebbles,	1 "	2134
" yellow and pebbly, Gordon,	20 "	2154
Slate, dark,	30 "	2184
SS., Hickory SS. (small gas),	18 "	2202
Slate, dark, to bottom,	2 "	2204

Caltergahn Well (No. 225).

April 27, 1888.

No. 2, on Caltergahn farm, Canonsburg district.

Conductor,	16 to	16
Slate, black,	48 "	64
Lime, black,	40 "	104
Coal,	6 "	110
Lime, gray,	4 "	114
Slate, black,	5 "	119
Lime, gray,	25 "	144
Slate and shells,	51 "	195
Slate, white,	20 "	215
Red rock,	3 "	218
Lime, gray,	30 "	248
Slate, white,	22 "	270
Red rock,	20 "	290
Slate, black,	13 "	303
Red rock,	5 "	308
Slate, white,	7 "	315
Limestone, gray (317′ of 8¼″ casing),	60 "	375
SS., white,	20 "	395
Red rock,	15 "	410
Lime, gray,	30 "	440
Red rock,	20 "	460
SS., white,	8 "	468
Slate, white,	20 "	488
SS., white,	32 "	520
Slate, black,	25 "	545
Lime, gray,	10 "	555
Red rock,	15 "	570
SS., red,	25 "	595
Slate, black,	65 "	660
Coal (gas),	6 "	666
Lime, white,	12 "	678
SS., white,	22 "	700
Slate, white,	20 "	720
SS., white,	20 "	740
Slate, white,	15 "	755
SS., red,	30 "	785
Limestone, gray,	15 "	800
SS., red,	8 "	808

Coal,	2 to	810
SS., red,	40 "	850
" black,	20 "	870
" white,	20 "	890
Slate and shells,	15 "	905
SS., black (gas),	60 "	965
Slate, white,	35 "	1000
SS., white,	50 "	1050
Slate, white,	3 "	1053
SS., white, Gas sand,	37 "	1090
" (gas in both sands),	85 "	1175
Slate, black,	35 "	1210
SS., white,	8 "	1218
Slate, black (1255′ of 6″ casing),	22 "	1240
SS., white and gray, Big Injun,	220 "	1460
Slate, black,	40 "	1500
SS., white,	55 "	1555
Slate, black,	45 "	1600
Lime, white,	85 "	1685
SS., white,	20 "	1705
Slate and shells, white,	90 "	1795
SS., gray,	30 "	1825
Slate and shells,	20 "	1845
SS., gray,	10 "	1855
Slate, black,	70 "	1925
SS., Gantz SS. (gas 8′ in it),	14 "	1939
Slate, black,	14 "	1953
SS., 50′ rock (large gas),	23 "	1976

Russell Well (*No. 226*).

April 30, 1888.

No. 1, on R. Russell farm, Canonsburg district.

Conductor,	11 to	11
Limestone, gray,	25 "	36
Slate, dark,	60 "	96
Limestone, gray,	15 "	111
Slate, white,	10 "	121
Red rock,	20 "	141
SS., white,	60 "	201
Slate, white (243′ of 8¼″ casing),	46 "	247
Limestone, gray,	10 "	257
Slate, black,	15 "	272
Red rock,	25 "	297
Slate, white,	35 "	332
SS., white,	45 "	377
Slate, dark and light,	143 "	520
SS., white,	20 "	540
Slate, light,	50 "	590
Lime, blue,	10 "	600
Slate, light,	10 "	610

SS., white,	35 to	645
Lime, very hard, dark,	25 "	670
SS., gray,	15 "	685
" black,	20 "	705
Slate, white,	10 "	715
Conglomerate,	25 "	740
SS., gray and white,	75 "	815
Lime, blue,	30 "	845
Slate, dark and light,	30 "	875
SS., gray and white (gas at 940′),	135 "	1010
Slate, dark (1016′ of 6″ casing),	10 "	1020
SS., dark, Big Injun,	75 "	1095
Slate, dark,	20 "	1115
SS., gray, Big Injun,	105 "	1220
Slate, in Big Injun,	10 "	1230
SS., gray, Big Injun,	80 "	1310
Slate,	20 "	1330
SS. and shells, continuation of Big Injun,	20 "	1350
SS., light,	25 "	1375
SS., gray, through Big Injun,	30 "	1405
SS., gray,	15 "	1420
Slate, gray,	195 "	1615
SS., dark-gray,	30 "	1645
Slate and shells,	50 "	1695
Slate, light,	50 "	1745
SS., Gantz SS. (gas at 1750′),	18 "	1763
Slate, dark,	4 "	1767
SS., light, 50′ rock,	78 "	1845
Slate, light,	45 "	1890
SS., light,	25 "	1915
Slate, light,	30 "	1945
SS., pink, Gordon Stray,	55 "	2000
SS., Gordon,	20 "	2020
Slate, light,	30 "	2050
SS., gray (gas),	23 "	2073
Slate, gray,	46 "	2119
SS., 100′ conglomerate,	8 "	2127
Slate, gray,	17 "	2144

Unproductive.

Fee Well (No. 230).

July 2, 1888.

On John Fee farm, Canonsburg district.

Clay,	14 to	14
Lime, gray, hard,	40 "	54
Slate,	26 "	80
Lime, blue,	20 "	100
Slate, dark,	15 "	115
Coal, slaty,	10 "	125
Lime, brown,	20 "	145

Slate,	15	to	160
Lime,	25	"	185
Slate, red,	40	"	225
Lime, blue (235′ of $8\frac{1}{4}$″ casing),	5	"	230
Slate, variegated, red and gray,	65	"	295
SS., gray,	30	"	325
Slate, pink,	20	"	345
" gray,	20	"	365
Lime, blue,	10	"	375
Slate, gray,	40	"	415
" red,	5	"	420
" gray,	50	"	470
SS., white,	20	"	490
Slate, pink,	20	"	510
" gray,	40	"	550
" dark,	50	"	600
" gray,	20	"	620
SS., gray,	15	"	635
Slate, gray,	60	"	695
Lime,	15	"	710
SS., gray,	65	"	775
" open (salt water at 780′),	20	"	795
Lime, very fine,	10	"	805
SS., gray, fine,	10	"	815
Slate, gray,	30	"	845
Slate, dark, soft,	25	"	870
" white,	90	"	960
" dark, gritty,	90	"	1050
SS., dark-gray (gas at 1065′),	80	"	1130
Slate, dark,	70	"	1200
SS., gray, open (1202′ of 6″ casing),	20	"	1220
Slate, gray, open,	30	"	1250
SS., close, Big Injun,	100	"	1350
" dark,	50	"	1400
Slate, gray,	50	"	1450
SS., gray, close,	35	"	1485
Slate, open,	60	"	1545
" and sand mixed,	195	"	1740
SS., dark, gray, fine,	40	"	1780
Slate, gray, close, shelly, Gantz and 50′,	60	"	1840
SS., gray, close, Gantz (gas at 1945′),	100	"	1940
Slate, gray,	40	"	1980
" and shells,	60	"	2040
" gray,	18	"	2058
SS., dark-gray, very hard; Gordon and Stray,	65	"	2123
Slate, dark,	34	"	2157
SS., gray, hard,	23	"	2180
Slate, dark-gray,	20	"	2200

Unproductive.

Records of 5 wells at Taylorstown, Buffalo township, Washington county.

These records show all the facts that are now usually kept, in regard to wells. Copied by permission from the books of J. M. Guffey & Co.

James McMannis, No. 1.

1887.

?	398 to 398
Coal, Pittsburgh, say,	7 " 405
?	715 " 1120
Salt water sand at	1120
? (salt water and gas in this interval),	135 to 1255
?	240 " 1495
Top of "Big Sand,"	1495
? (gas and water at 1585'),	975 to 2470
SS., Gordon sand,	14 " 2484
? to bottom,	16 " 2500

Well made a flow on second bit in Gordon sand, May 10, 1887. Production first 24 hours, 160 bbls.

408′ of 10″ casing, 747′ of $7\frac{5}{8}$″, 1414′ of $6\frac{1}{4}$″ and 1600′ of 5″.

Blaney Well.

1887.

Owners, Marshall Oil Company. Contractors, Hart Bros.

?	385 to 385
Coal, Pittsburgh, say,	7 " 392
?	2066 " 2458
SS., Gordon sand,	14 " 2472
? to bottom,	13 " 2485

Well made the first flow when 3 bits in the Gordon sand. Production first 3 hours, 50 bbls.; first 24 hours, 239 bbls.; second day, 204 bbls.; fourth, 175 bbls.; fifth, 160 bbls.; sixth, 144 bbls. Third day not measured.

Carson Well.

February, 1887.

Owners, the West Virginia Gas Company.

?	540 to 540
Coal, Pittsburgh,	10 " 550
?	2064 " 2614
SS., Gordon sand,	8 " 2622
?	138 " 2760

The Gordon sand was rather inferior. Small show of oil and gas. Well filled up gradually and made a small flow. 500′ of 10″ casing, 1010′ of $7\frac{5}{8}$″, 1540′ of $5\frac{5}{8}$″.

Jas. Noble Well No. 1.

February, 1887.

Owners, West Virginia Gas Co. and J. M. Guffey & Co.

?	125 to 125
Coal, thin, say	2 " 127
?	193 " 320
Coal, Pittsburgh, say	10 " 330
?	2062 " 2392
SS., Gordon sand,	12 " 2404
?	17 " 2421

Well flowed on third bit of Gordon sand. Production first day, 282 bbls; second, 266 bbls. 232′ of 10″ casing, 764′ of $7\frac{5}{8}$″ and 1358′ of $5\frac{5}{8}$″.

Cundall Well No. 1.

February, 1887.

Owners, Vandergrift & Reed.

?	240 to 240
Coal, Pittsburgh,	10 " 250
?	2075 " 2325
SS., Gordon sand,	12 " 2337
?	13 " 2350

Production first day, 182 bbls.; second, 172 bbls. 262′ of 10″ casing, 772′ of $7\frac{5}{8}$″ and 1312′ of $5\frac{5}{8}$″.

Taylorstown Wells.

Buffalo township, Washington county.

Name of Well.	Date.	$7\frac{5}{9}$'' casing.	$5\frac{5}{8}$' casing.	Pittsburgh coal.	Top sand.	Thickness.	Pocket.
John McMannis No. 1,	July 6, 1886,	800	1300	375	2375	12	15
" " No. 2,	. . . . .	782	1636	. . . . .	. . .	. . . . .	. . . . .
L. & S. Carson No. 1,	February 20, 1887,	1002	1540	550	2614	8	42
James Noble No. 1,	February 25, 1887,	764	1350	332	2392	12	17
" " No. 2,	August 4, 1887,	710	1310	262	2330	12	20
W. B. Crathers No. 1,	August 31, 1887,	890	1490	475	2553	13	23
Donahey Heirs No. 1,	July 14, 1887,	735	1273	264	2335	12	20
James Hodgens No. 1,	August 10, 1887,	752	1313	275	2350	12	13
John A. Flack No. 1,	. . . . .	1020	1575	503	2593	13	22
Robert Noble No. 1,	September 28, 1887,	911	1545	456	2532	12	16
Samuel Woodburn No. 1,	May 31, 1887,	750	1425	365	2435	14	21
Cundall No. 1,	February 23, 1887,	772	1312	262	2325	11	13
" No. 2,	September 3, 1887,	997	1343	270	2331	12	23
" No. 3,	September 14, 1887,	. . . . .	. . . . .	430	2525	12	30
James McMannis No. 1,	May 14, 1887,	747	1600	398	2470	14	16
V. M. Blayney No. 1,	January 19, 1887,	940	1513	456	2522	12	13
N. Neely No. 1,	. . . . .	903	1537	510	. . . .	. . . . .	. . . . .
J. F. Hilton No. 1,	February 7, 1888,	. . . . .	. . . . .	330	2420	. . . . .	. . . . .
Samuel Woodburn No. 2,	. . . . .	. . . . .	. . . . .	540	2630	. . . . .	. . . . .
Elisha Ely,	. . . . .	. . . . .	. . . . .	495	2550	. . . . .	. . . . .
Wm. Knox (Buffalo Oil Co.) No. 1,	. . . . .	. . . . .	. . . . .	480	2540	18	. . . . .

The last three records in the above tabulation were kindly furnished by Mr. Jos. W. Craig, in response to my letter, asking, in behalf of the Survey, for some data concerning his many wells in Washington county and elsewhere. All the others were received through the courtesy of Mr. T. J. Vandergrift. The list shows how well records are usually kept by large and successful oil companies. These are all the facts considered worthy of note, and from such skeletons the geologist is asked to work out every necessary detail of structure!

Monongahela Gas Well No. 1.

1886.

Located at Monongahela City, Carroll township, Washington county. Record as furnished by L. T. Linn to T. J. Vandergrift.

Floor of derrick 20′ below Pittsburgh coal.	
?	1300 to 1300
Gas in Big Injun at	1300
?	580 " 1880
SS., Gantz sand, some pebbles, ...	12 " 1892
Sandy shale with a few sand shells, ...	250 " 2142
SS., Gordon sand, very hard, ...	10 " 2152

"Some gas from the Big Injun, but the largest flow comes from the Gantz sand."

Monongahela Gas Well No. 2.

1887.

Same authority as well No. 1. The Pittsburgh coal lies on a level with the well mouth.

?	1900 to 1900
SS., Gantz sand, very pebbly, ...	18 " 1918
?	300? " 2218?

"No well-developed sand below the Gantz in this well. The gas supply comes from the Gantz and is much more abundant than in well No. 1."

Belle Vernon Gas Well No. 1.

September 15, 1887.

Located on John B. Carson farm, Allen township (?),

Washington county. Owners, Belle Vernon Light and Heat Co. Authority, Mr. S. F. Jones, President.

Well mouth above ocean in feet, about			1035
?	25 to	25	1010
Coal, Pittsburgh, estimated,	10 "	35	1000
? (salt water vein at 600'),	631 "	666	369
Coal, estimated,	3 "	669	366
?	131 "	800	235
Coal (large flow of gas), estimated,	3 "	803	+232
? (salt water at 900', eased 1090'),	287 "	1090	—55
Slate,	10 "	1100	—65
SS., white,	25 "	1125	—90
Slate,	30 "	1155	—120
SS., red,	20 "	1175	—140
Slate and shells,	10 "	1185	—150
SS.,	15 "	1200	—165
Red rock,	10 "	1210	—175
Limestone,	15 "	1225	—190
" hard,	39 "	1264	—229
SS., yellow,	46 "	1310	—275
Limestone,	18 "	1328	—293
SS. (little gas),	72 "	1400	—365
" black,	18 "	1418	—383
" white,	18 "	1436	—401
Slate,	12 "	1448	—413
SS., white,	107 "	1555	—520
Slate and shells,	37 "	1592	—557
SS., white,	120 "	1712	—677
Slate,	20 "	1732	—697
SS.,	14 "	1746	—711
Slate,	10 "	1756	—721
SS.,	8 "	1764	—729
Slate and shells,	116 "	1880	—845
Red rock,	20 "	1900	—865
Slate and pebbles (gas),	49 "	1949	—914
SS., hard,	71 "	2020	—985
" gray,	12 "	2032	—997
Slate and sand (gas),	8 "	2040	—1005
SS., hard (gas),	5 "	2045	—1010
" " "	15 "	2060	—1025

"This is the record as kept by the drillers. The gas sand was extremely hard and close, and consequently the minute-pressure only rises to 125 lbs. to the square inch."

Belle Vernon Gas Well No. 2.

May 21, 1888.

Located on the B. L. Parsons farm, East Pike Run township (?), Washington county, a little over 2 miles from

where the anticlinal crosses Monongahela river below Gibsonton. Owners, the Belle Vernon Light and Heat Co. Authority, Mr. S. F. Jones, President.

Well mouth above ocean in feet, about			985
Drive pipe, ...	13 to	13	972
SS., ...	80 "	93	892
Slate, ...	244 "	337	648
Coal, ...	10 "	347	638
Slate, ...	174 "	521	464
SS., ...	44 "	565	420
Slate, ...	135 "	700	285
SS. (gas), ...	15 "	715	270
Slate, ...	40 "	755	230
SS., ...	50 "	805	180
Slate, ...	15 "	820	165
SS. (water), ...	40 "	860	125
"	65 "	925	60
Coal, ...	8 "	933	+52
SS., ...	67 "	1000	—15
Slate (bottom of casing), ...	10 "	1010	—25
Limestone, ...	10 "	1020	—35
Red rock, ...	25 "	1045	—60
Slate, ...	30 "	1075	—90
SS., ...	25 "	1100	—115
Slate, ...	10 "	1110	—125
Limestone, ...	40 "	1150	—165
SS., yellow, ...	60 "	1210	—225
Limestone, ...	15 "	1225	—240
SS., white, ...	30 "	1255	—270
" black, ...	25 "	1280	—295
" white, ...	30 "	1310	—325
Slate, ...	20 "	1330	—345
SS., white, ...	110 "	1440	—455
Slate, ...	45 "	1485	—500
SS., white, ...	130 "	1615	—630
Slate, ...	20 "	1635	—650
SS., ...	15 "	1650	—665
Slate, ...	160 "	1810	—825
Red rock, ...	10 "	1820	—835
SS., black (gas), ...	60 "	1880	—895
Slate, ...	35 "	1915	—930
SS. (strong gas), ...	35 "	1950	—965

"This well had an open pressure in $5\frac{5}{8}$ inch casing of 15 lbs. per square inch; and when cased with 4-inch casing showed an open pressure of 25 lbs. After blowing off for over a month it was shut in and the minute pressure was 585 lbs. Rock pressure, 800 lbs."

"Of No. 3 well no record was kept; but the drilling was

about the same as No. 2, except that there was no break between the Gantz and what is called the Fifty-foot sand. It is tubed and shut in until required for use. The minute pressure is 620 lbs.; the rock pressure 850 lbs." (Dec. 7, 1888.)

West Alexander Well.

1887.

Located on McGraw's Run, about 3 miles west of West Alexander, Donegal township, Washington county. Authority, Wm. H. Hearne, of Wheeling, per T. J. Vandergrift.

Dirt,	14 to	14
Slate and limestone,	16 "	30
Coal,	2 "	32
Slate and limestone,	48 "	80
Coal (gas at the top),	2 "	82
Slate and stone,	78 "	160
" limestone,	70 "	230
Hard fire clay,	8 "	238
Shale and limestone,	52 "	290
SS., hard,	2 "	292
Slate and limestone,	11 "	303
SS., hard, black,	6 "	309
Slate and limestone,	31 "	340
Coal,	3 "	343
Slate and shale,	32 "	375
Coal,	1 "	376
Slate and shale,	64 "	440
Red rock,	2 "	442
Slate, soft,	83 "	525
Slate and shells,	50 "	575
SS., close, white,	38 "	603
Slate (cased at 606'),	117 "	620
SS., white,	15 "	735
" black, soft,	25 "	760
Slate and shells,	87 "	847
Red rock,	3 "	850
Slate and sand and shale (caved),	127 "	977
SS., gray (gas and salt water),	68 "	1045
Black slate and sand shales,	209 "	1254
SS., gray (fresh water at 1264', 1290' of $6\frac{1}{4}$" casing),	54 "	1308
Slate,	68 "	1376
SS., gray,	24 "	1400
Slate,	20 "	1420
Limestone,	16 "	1436
SS., white, hard (cased with 5" casing),	108 "	1544

Slate, black,	25 to 1569
SS., white,	31 " 1600
" and black (salt water 1637'),	62 " 1662
" hard,	18 " 1680
Slate and shale,	45 " 1725
SS., gray, close,	125 " 1850
Slate and shale,	7 " 1857
SS., gray,	153 " 2010
Slate,	7 " 2017
SS, dark,	76 " 2093
Slate,	17 " 2110
" pale red,	85 " 2195
"	25 " 2220
SS.,	293 " 2513
Slate,	2 " 2515
" red,	150 " 2665
"	35 " 2700
Limestone,	330 " 3030
Slate,	170 " 3200

Unproductive.

West Finley Well.

1888.

Located on A. Sprowl's farm, on Robinson's fork, 2½ miles S. W. of Good Intent, West Finley township, Washington county. Authority, T. J. Vandergrift.

Conductor,	12 to 12
Sand rock,	33 " 45
Limestone,	10 " 55
Red rock,	8 " 63
Slate,	43 " 106
Coal,	14 " 120
Slate,	10 " 130
Limestone,	20 " 150
Slate,	76 " 226
Coal,	6 " 232
SS.,	53 " 285
Coal,	2 " 287
Limestone,	43 " 330
" white,	85 " 415
Slate, black,	25 " 440
Limestone,	25 " 465
Slate,	40 " 505
Pittsburgh coal,	10 " 515
Slate, shelly,	35 " 550
Limestone,	15 " 565
Slate, shelly,	45 " 610
SS.,	120 " 730
Slate,	30 " 760

Limestone,	10 to	770
Red rock,	30 "	800
Sand, shelly,	25 "	825
Slate,	35 "	860
" pale red,	10 "	870
SS.,	20 "	890
Slate, black,	75 "	965
Red rock,	7 "	972
Shelly,	18 "	990
SS.,	55 "	1045
" black,	30 "	1075
" white,	5 "	1080
Slate, black,	25 "	1105
Lime shells,	30 "	1135
SS., black,	5 "	1140
" white (cased at 1152'),	20 "	1160
Lime, white,	40 "	1200
" black, shells,	10 "	1210
Slate, black,	40 "	1250
Sand shells,	5 "	1255
Slate, black,	27 "	1282
Lime, black,	8 "	1290
SS., black,	40 "	1330
Slate, black,	95 "	1425
Sand shells,	5 "	1430
Slate, black,	40 "	1470
SS., "Salt sand" (fresh water),	45 "	1515
Slate,	5 "	1520
SS.,	70 "	1590
" black,	5 "	1595
Limestone,	50 "	1645
SS., "Big Injun,"	100 "	1745
Slate,	5 "	1750
SS., "Big Injun,"	160 "	1910
Slate,	100 "	2010
SS., black,	105 "	2115
Slate,	137 "	2252
SS.,	33 "	2285
Slate and shell,	95 "	2380
" red,	50 "	2430
" white,	15 "	2445
Red rock,	15 "	2460
Slate,	20 "	2480
Red rock,	15 "	2495
Slate, white,	40 "	2535
Sand shells,	15 "	2550
Slate,	85 "	2635
SS.,	5 "	2640
Slate,	80 "	2720

Unproductive.

Ten Mile Well.

1887.

Located on the Meloy farm, near West Amity station, Amwell township, Washington county. Owners, The Ten Mile Oil Company. Authority, T. J. Vandergrift.

Conductor,	13 to	13
Slate,	22 "	35
Coal,	2 "	37
Slate and sand,	107 "	144
Coal,	5 "	149
Slate,	191 "	340
Limestone and slate,	60 "	400
Slate and shells,	55 "	455
Coal, Pittsburgh,	10 "	465
Slate and sandstone,	111 "	576
SS., hard,	24 "	600
Slate and red rock,	15 "	615
" blue (cased 662′),	47 "	662
SS., black,	13 "	675
Slate,	50 "	725
? (SS. and oil at 932′),	207 "	932
? (salt water at 1442′),	538 "	1470
Limestone,	30 "	1500
Slate, black,	80 "	1580
SS., or siliceous limestone,	30 "	1610
SS., Big sand,	280 "	1890
Slate,	30 "	1920
Limestone,	20 "	1940
Slate,	60 "	2000
SS.,	22 "	2022
Slate,	208 "	2230
Shells and slate,	55 "	2285
Slate,	51 "	2336
Red rock,	24 "	2360
SS. and pebbles (strong gas flow),	30 "	2390

This well was afterwards drilled deeper but found no other productive sands.

Hackney Well.

1889.

Located on the Hackney farm, Amwell township, Washington county, about half a mile east of the Waynesburg and Washington RR., where it crosses North Ten Mile creek. Authority, W. G. Gibson, contractor. Owners, Fergus & Co.

Well mouth above ocean in feet (from P. RR. levels),			940
Slate and limestone,	140 to	140	800
Coal, at		140	800
SS.,	12 "	152	788
Slate and limestone,	46 "	198	742
Limestone and slate,	255 "	453	487
Coal, at		453	487
Slate and limestone,	98 "	551	389
Coal, at		551	389
Slate,	49 "	600	340
SS.,	85 "	685	255
Slate,	85 "	770	170
" red,	5 "	775	165
"	85 "	860	80
SS.,	75 "	935	+5
Slate,	10 "	945	—5
SS.,	100 "	1045	—105
Slate,	55 "	1100	—160
Sand,	130 "	1230	—290
Slate,	195 "	1425	—485
SS., "Salt sand,"	110 "	1535	—595
Slate and lime,	110 "	1645	—705
SS., "Upper Big Injun,"	75 "	1720	—780
Slate,	12 "	1732	—792
SS., "Lower Big Injun,"	180 "	1912	—972
Slate and shale,	63 "	1975	—1035
SS.,	15 "	1990	—1050
Slate,	192 "	2182	—1242
Sand and shells,	53 "	2235	—1295
Slate,	50 "	2285	—1345
Sand, shells and slate (show of oil),	70 "	2355	—1415
SS. (strong gas at 2365') in it,	30 "	2385	—1445

Unproductive.

Chapter XIX.

New Well records in the counties of Greene and Fayette.

Smith Well, No. 3.

July, 1888.

Located on the John H. Smith farm, Morris township, Greene county, about one mile north 54° west of Nineveh. Owners, the Nineveh Petroleum Co. Authority, John Worthington, manager.

Well mouth above ocean in feet (Worthington),				1075
Conductor,	18	to	18 =	1057
SS., shelly,	25	"	43 =	1032
Limestone,	22	"	65 =	1010
SS.,	25	"	90 =	985
Coal, "Nineveh,"	2	"	92 =	983
Slate and limestone,	63	"	155 =	920
Coal,	1	"	156 =	919
Shale and limestone,	40	"	196 =	879
Slate,	25	"	221 =	854
Sand shells, slate and limestone,	79	"	300 =	775
Slate, sand shells and limestone,	240	"	540 =	535
SS.,	40	"	580 =	495
Coal, "Waynesburg,"	4	"	584 =	491
Fire clay and slate,	15	"	599 =	476
Slate, sand shells and limestone,	240	"	839 =	236
"	20	"	859 =	216
SS.,	21	"	880 =	195
Coal, "Pittsburgh,"	6	"	886 =	189
Shale,	15	"	901 =	174
Limestone and shale,	88	"	989 =	86
SS.,	25	"	1014 =	61
Red rock,	15	"	1029 =	46
Limestone and shale,	25	"	1054 =	+21
SS.,	65	"	1119 =	—44
Slate,	5	"	1124 =	—49
Red rock,	10	"	1134 =	—59
Limestone and sand shells,	20	"	1154 =	—79

Slate,	5 to 1159 =	—84
Limestone,	10 " 1169 =	—94
SS.,	20 " 1189 =	—114
Red rock,	20 " 1209 =	—134
Limestone,	10 " 1219 =	—144
SS.,	18 " 1237 =	—162
Slate,	20 " 1257 =	—182
SS.,	20 " 1277 =	—202
Slate,	60 " 1337 =	—262
Sand shells and slate,	30 " 1367 =	—292
SS., "Mahoning,"	30 " 1397 =	—322
Slate,	10 " 1407 =	—332
SS.,	70 " 1477 =	—402
Slate and sand shells,	100 " 1577 =	—502
SS.,	15 " 1592 =	—517
Slate,	35 " 1627 =	—552
SS.,	50 " 1677 =	—602
Slate,	25 " 1702 =	—627
Limestone, fire clay and shale,	83 " 1785 =	—710
Slate,	5 " 1790 =	—715
SS., bluish-gray,	85 " 1875 =	—800
" white,	80 " 1955 =	—880
" bluish-gray,	15 " 1970 =	—895
Slate,	40 " 2010 =	—935
Limestone and sand shells,	55 " 2065 =	—990
SS., "Big Injun,"	280 " 2345 =	—1270
Slate,	310 " 2655 =	—1580
SS., fine, bluish-gray "Gantz,"	40 " 2695 =	—1620
Sand shells,	50 " 2745 =	—1670
Slate,	60 " 2805 =	—1730
SS.,	8 " 2813 =	—1738
Slate,	27 " 2840 =	—1765
SS.,	30 " 2870 =	—1795
Slate,	65 " 2935 =	—1860
SS., "Gordon,"	35 " 2970 =	—1895

"This well, when drilled about 20 feet in the Gordon sand, struck oil, July 26, 1888, and flowed 3,940 barrels during the first 30 days. In attempting to clean it out and drill through the sand, a string of tools was dropped. A long fishing job ensued which was further complicated by the burning of the rig November 15, 1888, and the loss of other tools. Finally, after there had been anchored in the hole one full set of $4\frac{1}{4}$ inch tools, one full set of $5\frac{1}{2}$ inch tools and one $5\frac{1}{2}$ inch bit—in all about 130 feet of iron, fishing was abandoned. A string of $4\frac{1}{4}$ inch casing was then let down to the obstruction, and through this a new hole was drilled by the side of the fastened tools, and without

disturbing them, down to and through the Gordon sand. Oil was struck the second time, March 16, 1889, and the well again started to flow at the rate of 310 barrels per day, without a torpedo."

Auld Well.

April, 1889.

Located on the Hugh Auld farm, about two miles N. 15° West of Nineveh, Morris township, Greene county. Owners, the Nineveh Petroleum Co. Authority, John Worthington, manager.

?	560 to	560
Coal, "Waynesburg,"	4 "	564
?	302 "	866
Coal, "Pittsburgh,"	6 "	872
?	1128 "	2000
Limestone,	60 "	2060
SS., "Big Injun, upper" (gas at 2080'),	80 "	2140
Slate,	80 "	2220
SS.,	8 "	2228
Slate,	4 "	2232
Shells and slate,	178 "	2410
Slate,	170 "	2580
SS.,	10 "	2590
Slate,	35 "	2625
SS., "Gantz and Fifty foot,"	80 "	2705
Slate,	45 "	2750
Red rock,	10 "	2760
Slate,	70 "	2830
SS., white,	10 "	2840
" red,	30 "	2870
Slate,	40 "	2910
SS., "Gordon,"	29 "	2939
Slate,	11 "	2950
Red rock,	20 "	2970
Shale,	20 "	2990
Slate,	10 "	3000
SS., "Fourth sand" (large quantity of salt water),	11 "	3011

Unproductive.

Funk Well.

April, 1889.

Located on the Michael Funk farm, about one mile N. 78° W. of Nineveh, Morris township, Greene county. Owners, the Nineveh Petroleum Co. Authority, John Worthington, manager.

?	740 to 740
Coal, "Waynesburg,"	5 " 745
?	299 " 1044
Coal, "Pittsburgh,"	7 " 1051
?	1149 " 2200
Limestone,	40 " 2240
SS., "Upper Big Injun,"	60 " 2300
Limestone,	15 " 2315
Slate,	35 " 2350
SS., "Lower Big Injun,"	125 " 2475
Slate,	350 " 2825
SS., "Gantz,"	30 " 2855
Slate,	70 " 2925
Red rock,	10 " 2935
Slate,	75 " 3010
SS.,	30 " 3040
Slate,	45 " 3085
SS., "Gordon" (strong gas),	35 " 3120
Red rock,	5 " 3125
Slate and shells,	65 " 3190
SS., "Fourth sand" (little salt water),	15 " 3205
Slate, to bottom,	16 " 3221

Grimes Well.

April, 1889.

Located on the Grimes farm, about two miles N. 31° E. of Waynesburg, Greene county. Owned by the Home Company. Record furnished by the contractors.

?	535 to 535
Coal, "Pittsburgh,"	15 " 550
?	900 " 1450
SS., "Salt sand,"	175 " 1625
?	75 " 1700
Limestone,	60 " 1760
SS., "Big Injun" (little gas at 1766'),	240 " 2000
?	350 " 2350
SS., "Gantz sand,"	40 " 2390
?	110 " 2500
SS.,	50 " 2550
?	100 " 2650
SS., "Gordon sand,"	15 " 2665
?	70 " 2735
SS., "Fourth sand,"	13 " 2748
Slate and red rock, to bottom,	152 " 2900

Crab Apple Well.

1886.

Located north of Ryerson Station, in west part of Rich Hill township, Greene county. Authority, Guffey & Co.

?	295	to	295
Coal, "Pittsburgh,"	6	"	301
? (335′ of 9⅝″ casing),	199	"	500
Caving rock,	200	"	700
? (714′ of 7⅝″ casing),	140	"	840
First gas at			840
?	60	"	900
Second gas at			900
?	275	"	1175
SS., "Salt water sand," say	50	"	1225
?	25	"	1250
SS., "salt water sand,"	20±	"	1270
? (1271′ of 5⅝″ casing),	30	"	1300
SS., "Big sand,"	260	"	1560
?	390	"	1950
Red rock,	40	"	1990
?	383	"	2373
SS. (little gas),	10	"	2383
"Nearly all clean slate,"	333	"	2716

Sayers Well, No. 1.

February, 1889.

Located on the Robert A. Sayers farm, two miles east of Waynesburg, Greene county. Authority, the owner, W. S. Guffey,

Red rock,	16	to	16
SS., gray,	20	"	36
Limestone,	180	"	216
Slate, white,	4	"	220
Coal, "Sewickley,"	4	"	224
Slate, black,	10	"	234
Limestone,	30	"	264
Slate, black,	60	"	324
SS., black,	20	"	344
Coal, "Pittsburgh,"	10	"	354
Slate, white,	30	"	384
Limestone,	40	"	424
SS., white,	50	"	474
Red rock,	55	"	529
Slate, white,	30	"	559
Red rock,	80	"	639
Slate, white,	5	"	644
SS., "Dunkard Sand,"	40	"	684
Slate, white,	60	"	744
SS., white,	90	"	834
Slate, black, and shells,	140	"	974
SS., white,	12	"	986
Slate, black,	370	"	1356
Red rock,	50	"	1406

SS., white,	30 to	1436
Slate, white,	10 "	1446
Red rock,	5 "	1451
Slate, black,	10 "	1461
Limestone,	100 "	1561
SS., "Big Injun,"	270 "	1831
Slate, black,	80 "	1911
SS., white,	40 "	1951
Slate and shells,	190 "	2141
Slate, white,	12 "	2153
SS., "Gantz sand,"	30 "	2183
Slate and shells,	75 "	2258
SS., white,	10 "	2268
Slate and shells,	45 "	2313
Sand and pebbles,	10 "	2323
Slate and shells,	40 "	2363
Pebbles,	3 "	2366
SS., white,	30 "	2396
SS. and shells,	15 "	2411
" white,	40 "	2451
White pebbles,	10 "	2461
SS., gray,	30 "	2491
SS., white,	12 "	2503
Slate,	5 "	2508
SS., red,	18 "	2526
" red and white,	40 "	2566
" gray,	30 "	2596
Slate,	15 "	2611
Red rock,	15 "	2626
SS., white and gray, to bottom,	49 "	2675

Unproductive.

Van Kirk Well.

April, 1889.

Located on the Van Kirk farm, about two miles up South Ten Mile Creek from Jefferson, Greene county. Owners, the Jefferson Oil and Gas Co. Authority, Burrows & Dugan, contractors.

?	275 to	275
Coal, "Pittsburgh,"	10 "	285
?	455 "	740
SS., "Dunkark sand,"	120 "	860
?	32 "	892
SS., dark,	58 "	950
" "Salt sand,"	390 "	1340
" dark,	80 "	1420
Limestone,	80 "	1500
SS., "Big Injun,"	243 "	1743
Slate,	127 "	1870

SS., blue, "Thirty foot,"	40	to	1910
Slate,	176	"	2086
Shells and slate,	104	"	2190
SS., "Gantz" (little gas at 2192′ and 2200′),	15	"	2205
Slate,	105	"	2310
Red rock,	5	"	2315
Slate, light,	40	"	2355
SS., "Gordon," dark, very fine,	35	"	2390
Red rock,	40	"	2430
SS., "Fourth sand," gray, hard and close,	50	"	2480
Red rock,	147	"	2627
Slate, light, to bottom,	31	"	2658

Biddle Well.

1887.

Located on the Biddle farm, near Carmichaels, Cumberland township, Greene county. Owners, E. M. Hukill & Co. Authority, Robert Shear, contractor.

Conductor,	7½	to	7½
Limestone and layers of slate,	48½	"	56
" soft,	147	"	203
" hard,	62	"	265
Slate and shell,	35	"	300
SS.,	30	"	330
Slate,	5	"	335
Coal, Pittsburgh,	9	"	344
Slate and shells,	176	"	520
SS., (salt water),	50	"	570
Slate and shells,	62	"	632
SS.,	23	"	655
Slate,	40	"	695
Red rock,	5	"	700
Slate,	95	"	795
SS.,	35	"	830
Slate,	35	"	865
SS., "Dunkard Third sand,"	40	"	905
Slate,	4	"	909
SS.,	11	"	920
Slate,	35	"	955
" and shells,	80	"	1035
SS., dark-gray (gas 1040′, salt water 1050′ and 1180′),	165	"	1200
Slate and shells (1167′ of 7⅝″ casing),	35	"	1235
SS. (fresh water 1240′ and 1250′),	180	"	1415
Slate,	10	"	1425
Limestone,	75	"	1500
Red rock, red shale,	25	"	1525
Limestone,	60	"	1585
SS., "Big Injun" (salt water 1600′, 1613′ of 5⅝″),	240	"	1825
Slate and shells,	40	"	1865

SS., hard,	35	to	1900
Slate,	80	"	1980
SS.,	220	"	2200
Slate and hard sand shells,	10	"	2210
"	210	"	2420
Red rock, to bottom,	12	"	2432

"Some gas and show of oil in Big Injun."

Gregg Well.

1886.

Located on the Gregg farm, at Willow Tree, Greene township, Greene county. Owners and authority, E. M. Hukill & Co.

?	255	to	255
Coal, "Pittsburgh," say	5	"	260
? (697′ of $5\frac{5}{8}$″ casing),	437	"	697
SS., "Dunkard sand,"	28	"	725
Slate,	10	"	735
SS., white,	66	"	801
" black,	16	"	817
Slate and shells,	86	"	903
SS., white,	32	"	935
Slate and shells,	120	"	1055
Slate,	20	"	1075
SS., black (oil show),	17	"	1092
Coal,	8	"	1100
SS., white (salt water 1120′),	50	"	1150
Slate,	35	"	1185
SS., white (salt water 1220′),	90	"	1275
Red rock (1280′ of $4\frac{1}{4}$″ casing),	145	"	1420
SS., white (gas and salt water 1598′ and 1630′),	320	"	1740
Slate and shells,	15	"	1755
Slate,	30	"	1785
SS., red (oil show),	39	"	1824
Slate and sand shells,	140	"	1964
SS., gray,	36	"	2000
Slate and shells,	95	"	2095
SS., brown,	30	"	2125
Slate and pebbles,	15	"	2140
SS., gray, supposed to be Gantz,	25	"	2165

Lost tools April, 1886, and well abandoned.

Mount Morris Well No. 1.

October 21, 1886.

Located on the D. L. Donley farm, on Morris Run, a short distance southeast of Mount Morris, in Perry township,

Greene county. Owners, E. M. Hukill & Co. Authority, Mr. Hukill's notes.

?	260 to	260
Coal, "Sewickley," estimated,	3 "	263
?	97 "	360
Coal, "Pittsburgh," estimated,	8 "	368
?	572 "	940
SS., "Dunkard sand," estimated,	30 "	970
?	290 "	1260
SS., "salt water sand,"	55 "	1315
Slate and SS. (cased at 1332′ in slate),	85 "	1400
SS., white, red rock and limestone,	110 "	1510
?	125 "	1635
SS., "Big Injun" (gas 1650′, oil 1740′ and 1755′),	137 "	1772

This was the pioneer well at Mt. Morris. When first struck it was handled as a "mystery," and no reliable history of it could be obtained. It is said, however, to have produced naturally from 25 to 30 barrels per day. Several months later the drill was put in it and sunk to the horizon of the Washington county sands, but these were not found in productive form. In November, 1887, the lower part of the hole was plugged and a torpedo exploded in the "Big Injun" with very satisfactory results. Since then the drill has been active in the field and a pipe line has been laid for the delivery of oil. The pipe line report for December, 1888, shows that the runs from the field for that month averaged 729 barrels per day.

Brownsville Well, No. 2.

1887.

Belonging to the Home Natural Gas Co. of Brownsville, Fayette county, and located on Dunlap creek, about $\frac{7}{8}$ of a mile above its mouth. Authority, Henry Stewart, contractor, per E. C. Merrill.

Conductor,	18 to	18
Limestone,	35 "	53
SS., gray and shales,	450 "	503
Slate and shells,	100 "	603
SS., gray,	70 "	673
Slate and shales,	100 "	773
SS., white,	25 "	798
" black,	20 "	818
" white,	200 "	1018

Slate, black,	10 to	1028
SS., white,	55 "	1083
Slate and shells,	25 "	1108
SS., white,	35 "	1143
Slate and shale,	30 "	1173
Red rock,	100 "	1273
Slate and shale,	30 "	1303
SS., white,	500 "	1803
Slate and shales,	108 "	1911
SS., white, pebbly, gas sand,	25 "	1936
SS., red,	25 "	1961
Slate and shale,	65 "	2026
SS., white,	25 "	2051
Slate and shale,	55 "	2106

"This well was drilled considerable deeper without any material increase of gas."

Layton Station Well (*No. 120*).

April 10, 1888.

No. 1, on Carson farm, Layton Station, Tyrone township, Fayette county. Owners and authority, Philadelphia Gas Co.

Clay,	30 to	30
Slate, black,	10 "	40
SS., brown,	10 "	50
Slate, black,	25 "	75
SS., gray,	25 "	100
Slate, black,	5 "	105
" white,	5 "	110
SS., white,	30 "	140
" dark, with red,	10 "	150
Pink rock,	20 "	170
Shale, white,	5 "	175
Red rock,	78 "	253
Shale, black,	20 "	273
Red rock,	37 "	310
Limestone, dark,	55 "	365
SS., white,	100 "	465
" "	10 "	475
" "	175 "	650
Slate, white,	15 "	665
SS., white,	155 "	820
Slate and shells, white,	170 "	990
SS., dark,	45 "	1035
Slate and shells, white,	245 "	1280
Red rock,	160 "	1440
SS., gray,	15 "	1455
Red rock,	70 "	1525

Slate and shells, white,	90 to 1615
Shells, red,	20 " 1635
SS., gray,	10 " 1645
Slate and shells, white,	450 " 2095
Red, to bottom,	5 " 2100

Unproductive.

Upper Middletown Well.

1886.

Located on Hugh Thompson's lot, in Upper Middletown, Menallen township, Fayette county. Owners, Thompson, Ewing & Co. Contractor, Henry Stewart.

Conductor,	10 to 10
Coal,	4 " 14
Soapstone,	20 " 34
SS., white, hard,	15 " 49
Slate, black,	60 " 109
SS., white,	30 " 139
Limestone, blue,	10 " 149
Slate, black, and coal,	40 " 189
SS., white, hard,	38 " 227
Slate,	50 " 277
SS., "Salt sand" (gas),	20 " 297
Slate and coal,	80 " 377
" " shells,	40 " 417
SS.,	10 " 427
Slate,	40 " 467
SS., white, "100 foot" (cased at 605'),	138 " 605
Slate,	10 " 615
SS., black,	90 " 705
Red rock and slate,	145 " 850
SS., shaly,	20 " 870
" white,	145 " 1015
Slate,	5 " 1020
SS., white,	120 " 1140
Slate and shells,	80 " 1220
SS., white, hard,	35 " 1255
Slate and shells,	175 " 1430
SS., black, "Stray,"	18 " 1448
Slate, white,	15 " 1463
Slate, black, and shells,	175 " 1638
SS., pebbly,	30 " 1668
Slate and shells,	180 " 1848
Red rock,	310 " 2158
Slate and shells,	50 " 2208
SS., bluish,	20 " 2228
Slate, white, to bottom,	212 " 2440

Unproductive.

Thompson Well.

May 1886.

Located on the Dearth farm, Menallen township, three miles northwest of Uniontown, Fayette county. Owners, Thompson, Ewing & Co. Authority, Jos. Hutchinson, contractor.

Conduetor,	20 to	20
Slate,	10 "	30
Limestone,	10 "	40
SS. and slate,	30 "	70
Slate, black,	40 "	110
SS., black and hard,	20 "	130
Slate, white,	30 "	160
Red rock,	20 "	180
SS.,	10 "	190
Red roek,	25 "	215
Slate,	30 "	245
SS.,	25 "	270
Red roek,	20 "	290
Slate. black,	10 "	300
SS., white,	35 "	335
Slate and shells,	25 "	360
Coal,	1 "	361
Slate,	9 "	370
Shells, hard,	8 "	378
SS., white, pebbly,	100 "	478
Slate, dark,	50 "	528
SS., white, (gas),	28 "	556
Slate and shells,	35 "	591
SS. (salt water),	10 "	601
Slate, very blaek,	70 "	671
SS.,	5 "	676
Red roek,	20 "	696
Slate,	10 "	706
Red rock,	25 "	731
Slate,	5 "	736
Red roek,	20 "	756
Shale,	10 "	766
Red roek,	20 "	786
SS., white,	230 "	1016
Slate,	5 "	1021
Limestone,	90 "	1111
SS., white, hard (gas at 1200′ and 1212′),	190 "	1301
Slate and shale,	100 "	1401
SS., dark,	25 "	1426
Shale, white,	100 "	1526
Slate, white,	47 "	1573
SS., dark,	50 "	1623
Slate, white,	25 "	1648

SS., dark,	30 to 1678
Slate,	32 " 1710
SS. (gas),	2 " 1712

This well is reported to have been drilled to a depth of 2001 feet, but the lower part of the record was not obtained.

Mack Well.

March 10, 1888.

Located on farm of Jos. Mack, on North branch of Brown's Run, German township, Fayette county, about 6 miles southwest of Uniontown. Owners and authority, Fayette Fuel Gas Co.

Conductor,	15 to 15
Shale, sandy, dark, hard,	27 " 42
SS., blue, hard,	40 " 82
Slate, dark,	33 " 115
Shale, red,	20 " 135
Slate, blue,	15 " 150
SS., blue,	7 " 157
Shale, yellow,	16 " 173
SS., gray, hard,	19 " 192
Slate, blue, soft,	25 " 217
Limestone, gray,	10 " 227
Shale, sandy,	11 " 238
" red,	12 " 250
SS., white, hard,	50 " 300
Slate, blue,	26 " 326
SS., dark, hard,	6 " 332
Slate, blue,	24 " 356
SS., gray,	16 " 372
" light-gray, hard,	38 " 410
Shale and coal,	14 " 424
" brown,	19 " 443
Limestone, dark,	30 " 473
SS., gray, hard,	33 " 506
Shale, dark,	24 " 530
" black,	14 " 544
" blue,	60 " 604
SS., brown, hard,	26 " 630
" white, hard,	23 " 653
Shale and coal,	16 " 669
SS., white, hard,	18 " 687
Shale, blue,	50 " 737
SS., white,	47 " 784
Shale, black (cased at 796')	20 " 804
SS., gray,	15 " 819

Shale, dark,	42 to	861
SS., light, hard,	20 "	881
Shale, blue,	8 "	889
Slate, red,	33 "	922
SS., blue, soft,	39 "	961
Shale, red, some lime,	20 "	981
Limestone, shaly, blue,	23 "	1004
" hard,	18 "	1022
" very hard,	33 "	1055
" shaly, soft,	20 "	1075
" siliceous and red,	12 "	1087
Shale, soft,	7 "	1094
Limestone, siliceous, white,	59 "	1153
SS., white,	30 "	1183
" (strong gas),	13 "	1196

The Ryder well, a short distance in an east-north-east direction from the Mack well, and drilled in 1887, found a succession of strata similar to the above, and a more prolific gas rock, being the most powerful gas well yet discovered in the "Big Injun" sand in Fayette county. The gas from these wells is piped to Uniontown and seems capable of supplying all the needs of the place.

Cats' Run Well.

1888.

Located on the farm of S. T. Gray, on Cats' Run, in the village of Masontown, German township, Fayette county. Owners, Masontown Oil Co. Authority, Geer Bros., contractors.

Well mouth 30' below Pittsburgh coal.

?	375 to	375
SS., gray, hard,	15 "	390
Shale, black,	60 "	450
SS., "Upper Mahoning,"	35 "	485
Shale and limestone,	20 "	505
Shale, dark,	45 "	550
SS., "Lower Mahoning,"	50 "	600
Shale, black,	40 "	640
SS., gray,	8 "	648
Shale, black,	35 "	683
SS., gray,	18 "	701
Shale, dark,	30 "	731
SS., dark,	25 "	756
Shale, black,	40 "	796
" gray,	6 "	802
" black,	16 "	818

SS., white,	15 to	833
" dark,	30 "	863
" white,	7 "	870
" " soft,	108 "	978
Shale and coal,	4 "	982
SS., soft,	18 "	1000
" white, hard,	36 "	1036
Limestone, shaly,	24 "	1060
" and red shale,	70 "	1130
" greenish, shaly,	10 "	1140
" red, soft,	60 "	1200
" sandy, white,	32 "	1232
" shaly,	43 "	1275
" sandy, white,	17 "	1292
" shaly,	11 "	1303
" sandy,	77 "	1380
SS., white (oil show),	41 "	1421
Shale, sandy,	34 "	1455
SS., gray,	10 "	1465
Slate, sandy,	15 "	1480
SS., gray, hard,	10 "	1490
Shale, dark,	50 "	1540
SS., gray, soft,	95 "	1635
Shale, dark,	130 "	1765
SS., gray,	15 "	1780
Shale, dark,	85 "	1865
SS., "Gantz sand" (gas at 1894'),	35 "	1900
Shale,	5 "	1905
SS., "50 ft.,"	60 "	1965
Slate and shells,	185 "	2150
SS., "Gordon sand,"	5 "	2155
Shale, sandy, red,	227 "	2382
SS.,	15 "	2397
Slate, sandy,	53 "	2450
Slate to bottom,	75 "	2525

Chapter XX.

Unpublished Oil Well records in New York, West Virginia, Ohio, Kentucky and the Indian Territory.

Charlotte Well, No. 1.

1883.

Located on the farm of John Luce, three-qnarters of a mile northeast of Charlotte Center, Charlotte township, Chautauqua county, N. York.

Well mouth above ocean in feet (barometer),				1600
Drive pipe,	97	to	97	1503
Slate,	38	"	135	1465
SS, very fine, slaty,	100	"	235	1365
Slate, common,	635	"	870	730
" and shells,	50	"	920	+680
" common,	800	"	1720	—120
" dark,	115	"	1835	—235
" common,	50	"	1885	—285
" black, pyrites,	125	"	2010	—410
" common,	75	"	2085	—485
" limy,	20	"	2105	—505
Limestone, brown-gray,	15	"	2120	—520
Slate, common, to bottom,	212	"	2332	—732

Unproductive.

Charlotte Well No. 2.

1888.

Located on the farm of Addison Lake, half a mile east of Charlotte Center, Charlotte township, Chautauqua county, N. York.

Well mouth above ocean, in feet (barometer),				1590
Conductor,	14	to	14	1576
Slate,	36	"	50	1540
SS., blue, hard,	12	"	62	1528
Slate, shaly,	418	"	480	1110
" sandy, some lime (little gas),	15	"	495	1095
" (shells and gas at 600'),	190	"	685	905
" and thin, hard sand shells,	205	"	890	700

SS., limy (show of heavy oil),	8 to	898	692
Slate and shells (gas at 945′),	62 "	960	+630
" common,	670 "	1630	—40
SS., dark, fine-grained,	8 "	1638	—48
Slate, common,	192 "	1830	—240
" dark,	30 "	1860	—270
" common,	40 "	1900	—310
" black, pyrites,	130 "	2030	—440
" common,	65 "	2095	—505
" dark, limy, fossils,	20 "	2115	—525
Limestone, brown-gray,	20 "	2135	—545
Slate, common,	127 "	2262	—672

A weak flow of gas but of no commercial value.

Honeoye Falls Well.

1887.

Located at Honeoye Falls, Monroe county, N. York, 16 miles from Rochester, 7 miles from West Bloomfield, where there are 3 or 4 gas wells. Authority, A. Parmlee.

Earth,	13 to	13	
Flint rock,	75 "	88	
Quarry rock,	75 "	163	
Red granite,	85 "	248	
Black rock,	245 "	493	
Slate rock,	212 "	705	
White putty rock,	35 "	740	
Red rock,	144 "	884	
Shale, black,	400 "	1284	
" red,	216 "	1500	

Croxton's Run Well.

November, 1885.

Located on Croxton's Run, Sapp farm, Knox township, Jefferson county, Ohio, about four miles west of Toronto. Authority, T. J. Vandergrift, owner.

Red rock and slate (Crinoidal lime (?) at 25′),	100 to	100	
SS.,	50 "	150	
Slate (cased at 300′),	150 "	300	
" and red rock,	400 "	700	
SS. (show of black oil),	80 "	780	
Slate,	220 "	1000	
SS. (oil show),	40 "	1040	
Slate and hard shells (little gas at 1275′),	280 "	1320	
Red rock,	10 "	1330	
Slate, gray,	10 "	1340	
Shale, black, to bottom,	115 "	1455	

Unproductive.

Vandergrift Well.

March, 1886.

On John Whitehill farm, Poe district, Hancock county, W. Va., about 250 rods west of the State line. Authority, T. J. Vandergrift, owner.

?	290 to	290
SS., First sand,	40 "	330
?	170 "	500
SS., Salt water sand,	75 "	575
?	175 "	750
SS.,	15 "	765
?	75 "	840
SS.,	20 "	860
?	160 "	1020
SS.,	10 "	1030
?	40 "	1070
SS.,	25 "	1095
" white (gas),	10 "	1105
Slate,	155 "	1260
Red rock,	25 "	1285
Slate,	155 "	1440
Red rock,	12 "	1452
Slate and shale, to bottom,	248 "	1700

Unproductive.

Saunders' Well.

1861.

Located on bank of Cross Creek, about one mile from its mouth, on the Saunders farm, Cross Creek district, Brooke county, West Virginia. Authority, Mr. Saunders' note book.

"Crinoidal limestone 85′ above well mouth."

Conductor,	18 to	18
Fire clay and shale (3′ coal; 9′ red shale),	40 "	58
Soapstone, blue,	21 "	79
SS.,	50 "	129
Fire clay and coal,	68 "	197
SS.,	13 "	210
Shale,	20 "	230
Coal,	5 "	235
?	9 "	244
SS., very hard,	2 "	246
Slate, blue, hard (gas 253′, oil show 260′),	44 "	290
SS., white, hard (little oil 301′),	40 "	330
Limestone,	7 "	337
SS., blue, very hard,	22 "	359

Coal,	5 to 364
Limestone,	43 " 407
SS., bastard,	37 " 444
Soapstone (smell of oil),	12 " 456
Limestone,	36 " 492
SS., very hard,	4 " 496
Soapstone,	4 " 500
SS.,	4 " 504
Soapstone,	21 " 525
Slate, black,	5 " 530
Soapstone,	15 " 545
?	5 " 550
SS., very hard, pebbles in top (gas at 552'),	25 " 575
Slate, black, and SS., coarse and gray,	19 " 594
SS., very hard on top,	40 " 634
Slate,	5 " 639
Gray rock and horseback,	31 " 670
SS., white,	2 " 672
Limestone, very hard,	24 " 696
?	9 " 705
SS., very hard (oil show at 760'),	60 " 765

Unproductive. Well deepened from 575' in April, 1865.

Allison Well.

January, 1886.

Located on E. W. Allison farm, Grant district, Hancock county, W. Va., a mile and a half west of State line. Authority, T. J. Vandergrift, owner.

?	40 to 40
Coal,	5 " 45
? (gas and oil show at 860'),	1205 " 1250
Red rock, say	20 " 1270
?	50 " 1320
Hard shell, say	5 " 1325
Slate and shells,	115 " 1440
SS., shelly,	25 " 1465
Slate, to bottom,	5 " 1470

Unproductive.

Board Tree Well.

April 29, 1887.

Located on the Geo. Earnest farm, in Liberty township, Marshall county, West Virginia, within a few rods of the southwest corner of Pennsylvania. Owners, J. M. Guffey & Co. Contractor, Owen Murphy.

?	350	to	350
First coal,	5	"	355
? (550′ of 10″ casing),	195	"	550
Second coal,	10	"	560
?	140	"	700
Third coal,	8	"	708
?	92	"	800
Fourth coal,	15	"	815
? (1110′ of 8¼″, 1357′ of 6¼″ casing),	735	"	1550
Top of Salt water sand and some gas at			1550
SS. (?) (salt water at 1575′ and 1800′),	265	"	1815
? (1825′ of 5″ casing),	1095	"	2910
SS., "Gordon sand,"	18	"	2928
Slate, to bottom,	6	"	2934

"The Gordon stray was very much broken and very shelly." Unproductive.

Morgantown Well.

Spring of 1885.

Located at Morgantown, Monongalia county, West Virginia.

Conductor,	7	to	7
SS., hard, gray,	75	"	82
Shales, sandy,	15	"	97
Coal,	3	"	100
Shales, sandy,	40	"	140
Coal,	4	"	144
Shales and sand,	76	"	220
Coal,	4	"	224
Shales and SS.,	100	"	324
SS., coarse, gray (water),	20	"	344
Shales, blue,	20	"	364
SS., hard, white (pockets of gas),	200	"	564
" " micaceous,	36	"	600
Shales, greenish-gray (cased 606′),	100	"	700
" red and greenish sandy beds,	120	"	820
Limestone, impure,	10	"	830
Shale, red,	20	"	850
Limestone,	60	"	910
Red sandy beds,	10	"	920
SS., hard, gray, with shales (gas at 1375′),	730	"	1650
Shales, red and green,	378	"	2028
" dark bluish-gray, to bottom,	239	"	2267

Nickel Plate Well No. 1.

1883.

Located in Pleasants county, West Virginia, on property

of Rock City Mining and Manufacturing Co. Authority, Mr. B. F. Nye, of Marietta, Ohio.

?	342	to	342
SS., Salt water sand (cased at 542′),	200	"	542
Shale, "Macksburg shale,"	386	"	928
SS., "Macksburg sand" (oil show),	20	"	948
?	52	"	1000
SS., micaceous, no oil (torpedoed 1040′),	40	"	1040
Limestone, "Nigger head," and shale,	710	"	1750
SS., and some oil and gas at			1750
Limestone and shale,	250	"	2000
SS. and large increase of gas at			2000
Limestone and shale,	200	"	2200
SS., brownish-gray,	25	"	2225
Limestone and shale, black slate at bottom,	84	"	2309

"No red rock found in well." Unproductive.

Edwards Well No. 1.

1886.

Located in Kanawha Valley, near the old burning spring, about 8 miles above Charleston, Malden township, Kanawha county, W. Virginia. Owners and authority, Pittsburgh and Kanawha Natural Gas Co.

Conductor (trace of coal at 53′),	53	to	53
SS., white, hard,	100	"	153
Slate, gray,	8	"	161
SS., gray (oil smell),	40	"	201
Slate, dark,	25	"	226
SS., white, hard,	174	"	400
Coal,	6	"	406
SS., white, hard (salt water),	200	"	606
Slate,	10	"	616
Limestone, white,	50	"	666
Slate, white,	40	"	706
SS., white, hard,	255	"	961
Slate, black,	2	"	963
SS., white, hard,	50	"	1013
" blue,	50	"	1063
Limestone, blue (gas 1220′),	300	"	1363
Red rock,	50	"	1413
SS., coarse, "oil sand,"	2	"	1415
Slate, blue,	437	"	1852
" black,	75	"	1927
" blue,	73	"	2000
" dark,	250	"	2250
" greasy,	100	"	2350
" and bastard sand, to bottom,	100	"	2450

A moderate flow of gas at 1220′.

Edwards Well No. 2.

1887.

Located at Malden, Malden township, Kanawha county, West Virginia. Owners and authority, same as Well No. 1.

Drive pipe,	60 to	60
SS., white,	30 "	90
Slate,	10 "	100
SS., white,	240 "	340
" dark,	10 "	350
Coal and slate,	6 "	356
SS., soft,	100 "	456
?	100 "	556
Limestone,	20 "	576
Broken rock, and water crevice,	24 "	600
SS., white,	100 "	700
" " fine,	50 "	750
" " soft,	30 "	780
" blue, hard,	20 "	800
" dark,	74 "	874
Slate, dark,	10 "	884
Limestone, blue,	10 "	894
Slate, red,	2 "	896
SS., bastard, and lime,	20 "	916
Lime, blue, water (thickness questionable),	50 "	966
Slate, to bottom ("no sand here"),	834 "	1800

A moderate flow of gas which was piped to the salt works in the neighborhood.

Edwards Well No. 3.

1887.

Located near the city water works, Charleston, Kanawha county, West Virginia. Owners and authority, same as well No. 1.

Conductor,	28 to	28
?	12 "	40
Slate (coal at 74),	34 "	74
SS. (90′ of 8″ casing),	76 "	150
Slate (coal at 192′),	42 "	192
" and SS.,	68 "	260
Limestone,	20 "	280
SS.,	60 "	340
Slate,	60 "	400
SS., "Gas sand" (coal at 470′),	70 "	470
?	20 "	490
Slate,	20 "	510

SS.,	50 to	560
Slate,	30 "	590
SS.,	20 "	610
" white,	30 "	640
" hard,	65 "	705
" and shells,	75 "	780
" " " white,	20 "	800
" " " hard (gas),	55 "	855
" white,	90 "	945
?	55 "	1000
SS., black,	10 "	1010
" white,	10 "	1020
" black,	15 "	1035
" white,	5 "	1040
" shelly,	10 "	1050
" white,	25 "	1075
" shelly,	10 "	1085
" white,	30 "	1115
" shelly, hard,	10 "	1125
" white,	35 "	1160
" black,	10 "	1170
Slate,	10 "	1180
Limestone,	10 "	1190
SS., white (salt water at 1230′),	60 "	1250
Limestone (cased at 1250′; gas at 1315′),	200 "	1450
?	25 "	1475
SS., pebbly (salt water),	40 "	1515
" red,	85 "	1600
" shelly and slaty,	12 "	1612
" gray,	80 "	1692
Slate, to bottom,	148 "	1840

Unproductive.

Winifrede Coal Co. Well.

1887.

Located on Fields Creek, Cabin Creek township, Kanawha county, West Virginia, about 13 miles southeasterly from Charleston. Owners and authority, Winifrede Coal Co.

Conductor,	32 to	32
Coal, "Winifrede,"	4 "	36
?	11 "	47
SS., stray,	51 "	98
Slate,	5 "	103
Coal,	2 "	105
SS.,	20 "	125
Slate,	25 "	150
SS.,	115 "	265
Slate,	10 "	275

SS.,	39 to	314
Coal,	2 "	316
Slate,	105 "	421
Coal,	2 "	423
SS.,	8 "	431
? (cased),	9 "	440
SS.,	120 "	560
Coal,	4 "	564
Slate,	21 "	585
SS. (salt water),	635 "	1220
"	235 "	1455
Slate,	15 "	1470
SS.,	105 "	1575
Limestone, "Long Run rock,"	15 "	1590
SS. (little strong brine at 1622'),	160 "	1750
Slate,	10 "	1760
Shale, red,	15 "	1775
Slate, black,	5 "	1780
"	10 "	1790
Red rock and shale,	70 "	1860
Limestone, "Green briar,"	140 "	2000

Unproductive.

Rice Well No. 14.

Deepened August, 1879.

Located at Macksburg, Washington county, Ohio, about 40 rods west of Rice Well No. 7. Owner and authority, Geo. Rice.

? to bottom of original well,	632 to	632
?	78 "	710
SS.,	98 "	808
Shale,	8 "	816
SS. (gas at 818'),	14 "	830
Shale,	12 "	842
SS. (pebbles at 904'),	70 "	912
Black smut,	13 "	925
SS., very hard,	17 "	942
Shale, black,	8 "	950
SS.,	14 "	964
Shale,	4 "	968
SS., Salt water sand (water at 978'),	210 "	1178
Shale, black,	339 "	1517
SS., good (oil and gas at 1524'),	10 "	1527
" blue, fine,	49 "	1576

This was the first successful well drilled to the Macksburg sand.

Rice Well No. 7.

Drilled, 1876; deepened, 1882.

Located at Macksburg, Washington county, Ohio. Owned by Mr. Geo. Rice. Authority, ?

"Well mouth 199′ above low water at Marietta."

?	187	to	187
SS., First sand,	33	"	220
?	115	"	335
Coal at			335
?	41	"	376
Coal,	3	"	379
Shale, dark,	11	"	390
SS., shaly (oil and gas),	16	"	406
" good,	62	"	468
Limestone,	28	"	496
SS.,	24	"	520
Coal,	4	"	524
?	36	"	560
SS., Third sand, white, soft,	32	"	592
Shale, soft, blaek,	2	"	594
Limestone,	20	"	614
? (gas at 728′),	120	"	734
SS.,	8	"	742
? (gas at 761′),	59	"	801
SS.,	10	"	811
Limestone,	2	"	813
?	14	"	827
SS., Oil sand,	77	"	904
Shale, blaek, hard streaks,	54	"	958
? (commencing to drill deeper),	7	"	965
SS., at			965
? (water at 972′),	557	"	1522
SS., Macksburg sand (oil and gas at 1525′), say	22	"	1544
?	29	"	1573
Sand shells, very hard,	12	"	1585
Flint and shell,	12	"	1597
Shale, hard,	128	"	1725
Sand and shale (soft at 1840′),	137	"	1862
Flint roek,	4	"	1866
Shale,	29	"	1895
SS., very hard, dark-eolored,	100	"	1995
Shale, dark, very soft,	195	"	2190
Shell,	10	"	2200
SS.,	12	"	2212
?	13	"	2225
SS., very hard,	10	"	2235
Hard drilling,	11	"	2246
Soft drilling,	134	"	2380
Shale (shells at 2404′ and 2419′),	100	"	2480
SS., bastard,	20	"	2500

Shot from 1522′ to 1542′ with 100 lbs of powder, January, 1883. A good well in the Macksburg sand.

Gallipolis Well No. 1.

1887.

Located at Gallipolis, Gallia county, Ohio. Owners, Gallipolis Natural Gas Co. Authority, S. R. Smith, Sup't.

Conductor,	53 to	53
SS., brownish, coarse,	32 "	85
Shale and black sand,	240 "	325
Coal (some heavy oil),	4 "	329
SS., slaty and shelly, gray,	171 "	500
Shale, sandy,	78 "	578
Coal,	7 "	585
Slate and shells,	93 "	678
SS., white (much salt water),	12 "	690
Slate and shells,	40 "	730
SS., very hard, flaky (salt water),	13 "	743
Slate,	18 "	761
Limestone, shaly, not solid,	6 "	767
SS., white, very hard,	73 "	840
Shale, dark,	22 "	862
Red rock,	18 "	880
Slate, very black,	50 "	930
SS., gray (salt water and gas),	117 "	1047
Slate and shells, black,	43 "	1090
SS. and shale, black,	123 "	1213
SS., white, soft (salt water),	2 "	1215
Slate and shale, black,	44 "	1259
Slate, light, good drilling,	216 "	1475
SS., white, fine, hard (salt water),	32 "	1507
Shale, black, same all through (cased 1520′),	951 "	2458
SS., white (1 barrel lubricating amber oil dipped),	3 "	2461
Slate or shale, very black, soft,	404 "	2865
Limestone, very hard, perfectly dry,	45 "	2910

Unproductive.

Blaine Creek Well.

1885.

Located at mouth of Blaine Creek, Lawrence county, Kentucky. Owners, Regdon & Co.. Authority, E. O. Taylor, Contractor.

Conductor,	20 to	20
SS., yellow,	15 "	35
SS., white,	45 "	80
Shale, gray and red rock, mixed,	35 "	115

SS., gray,	25 to	140
SS., white,	170 "	310
Shale, brown,	45 "	355
SS., gray,	60 "	415
Slate, black,	15 "	430
SS., white,	110 "	540
Shale, gray,	50 "	590
Shale, black,	20 "	610
SS., gray (gas and salt water),	125 "	735
Slate, black,	30 "	765
SS., white (gas and salt water),	95 "	860
Shale, black,	10 "	870
SS., white and conglomerate,	365 "	1235
SS., green,	5 "	1240
Slate, gray, shells all through,	410 "	1650
Slate, black,	10 "	1660
SS., Gas sand, white,	2 "	1662
SS., lime and shells,	15 "	1677
SS. and shale mixed,	65 "	1742
Slate, black,	5 "	1747
SS. and shells,	5 "	1752
Slate, bluish black,	648 "	2400
Slate, light gray,	192 "	2592
Limestone,	5 "	2597

Unproductive.

Horseford Well.

1886.

On David Thompson farm, one mile and a half S. W. from mouth of Blaine Creek, Lawrence county, Kentucky. Owners, Regdon & Co. Authority, E. O. Taylor, Contractor.

Conductor,	15 to	15
Fire clay,	5 "	20
SS., dark blue,	15 "	35
Slate, gray,	5 "	40
SS., white,	20 "	60
Slate, black,	5 "	65
SS., dark gray,	30 "	95
Slate, black,	50 "	145
Coal,	3 "	148
Fire clay,	7 "	155
SS., white,	45 "	200
SS., dark,	20 "	220
Slate, black,	15 "	235
SS., dark gray,	25 "	260
Shale, black,	10 "	270
Coal,	3 "	273
Slate, white,	27 "	300

SS., gray,	6 to	306
Slate, black,	24 "	330
SS., dark gray,	25 "	355
Coal,	7 "	362
Fire clay,	3 "	365
SS.,	70 "	435
Slate, gray,	60 "	495
SS., gray,	25 "	520
Slate, black,	60 "	580
SS., white,	25 "	605
Slate, black,	5 "	610
SS., white,	45 "	655
Slate, gray,	15 "	670
SS., black,	20 "	690
Slate, gray,	20 "	710
SS., white and gray,	150 "	860
Slate, black,	10 "	870
SS., white,	90 "	960
Shale, black,	25 "	985
SS. and shells,	10 "	995
SS., blue,	30 "	1025
Limestone, white,	140 "	1165
SS., white,	5 "	1170
SS., slate and shells mixed,	20 "	1190
SS., green,	70 "	1260
Shale, green,	65 "	1325
Shale, bluish gray,	375 "	1700
Slate, black,	27 "	1727
SS., Gas sand, light gray (gas),	60 "	1787
Shale, black,	53 "	1840

Unproductive.

Griffith Creek Well.

1886.

Located on Griffith Creek, Lawrence county, Kentucky, about 9 miles southwest of Louisa. Authority, Ruff & Watkins, drillers.

Drive pipe,	40 to	40
SS., white,	20 "	60
Shale,	10 "	70
SS., black,	6 "	76
Soapstone,	10 "	86
Shale, sandy,	15 "	101
" black,	115 "	216
SS.,	4 "	220
Shale (oil show 250′),	112 "	332
SS., white (salt water),	315 "	647
Shale, red,	6 "	653
" black,	3 "	656

SS., white (cased at 780'),	118 to	774
Shale, black,	16 "	790
Limestone,	152 "	942
Shale, blue (oil show at 1423'),	481 "	1423
SS., gray (oil show and gas at 1510'),	87 "	1510
?	20 "	1530
Shells, hard,	4 "	1534
Shale, black, and lime shells,	644 "	2178
Lime, and oil under,	3 "	2181
Shale, blue (gas at 2211'),	30 "	2211
" green (gas at 2350'),	158 "	2369
" black and blue, to bottom,	38 "	2407

Unproductive.

Berry Well.

1885.

Located in Lawrence county, Kentucky, about 20 miles west of Louisa, and near Hood Creek. Owners and authority, Northrup & Vinson.

Conductor,	20 to	20
Shale,	82 "	102
SS., hard,	25 "	127
" fine, and shale,	14 "	141
" dark,	10 "	151
Shale,	9 "	160
SS., gray,	63 "	223
Shale, clayey,	4 "	227
SS., gray,	36 "	263
" white,	137 "	400
Shale,	95 "	495
Limestone,	152 "	647
?	195 "	842
SS., gray,	48 "	890
Shale, blue,	15 "	905
" black,	195 "	1100
SS., and shale,	515 "	1615
" " blue shale,	105 "	1720
Limestone and sand (oil and gas at 1740'),	20 "	1740
" white,	80 "	1820
" and some sand,	65 "	1885
SS., reddish, hard,	27 "	1912
" yellow (oil),	3 "	1915
" reddish, speckled, hard,	2 "	1917
" dark (oil),	28 "	1945
Limestone, to bottom,	160 "	2105

Unproductive.

Laurel Well.

April, 1886.

Located on Hood Creek, Lawrence county, Kentucky. Authority, R. F. Vinson, Louisa, Ky.

Conductor,	19 to	19
SS.,	14 "	33
Clay,	7 "	40
SS.,	78 "	118
Shale,	52 "	170
SS.,	50 "	220
Coal,	2 "	222
Slate and clay,	12 "	234
Limestone (cased at 239'),	104 "	338
SS.,	27 "	365
Limestone,	26 "	391
Slate,	384 "	775
SS.,	10 "	785
" "bastard,"	99 "	884
Shale, light and dark,	580 "	1464
SS.,	16 "	1480
Limestone, hard, layers of SS.,	145 "	1625

Black sulphur water at 1607'. Well plugged at 350' and shot at 320'. Some oil obtained from this limestone.

Warfield Gas Well No. 1.

December, 1883.

Located on the property of the Tug River Coal and Salt Company, on the west bank of Tug fork of Big Sandy river, near Warfield, Martin county, Kentucky, and nearly opposite the celebrated burning spring in Virginia. Owners, the Nickel Plate Oil Company. Record compiled from specimens preserved by Capt. A. Adams, and the drillers' notes.

Drive pipe,	32 to	32
?	11 "	43
Coal,	7 "	50
SS., gray,	97 "	147
Coal,	3 "	150
SS., white (cased at about 200'),	50 "	200
Shale (little salt water at 210'),	75 "	275
SS.,	20 "	295
Shale,	214 "	509
SS., "sugar sand,"	71 "	580
"Smut seam,"	1 "	581
?	12 "	593

SS. (oil show near bottom),	88 to	681
Shale,	18 "	699
SS.,	51 "	750
Shale,	200 "	950
SS., pebbly (little oil and gas),	50 "	1000
Shale, white and blue,	200 "	1200
SS., pebbly, coarse,	10 "	1210
Shelly drilling,	90 "	1300
Limestone, sandy (large gas flow),	7 "	1307

This well has since been drilled considerably deeper, but was not improved.

Guffey Well.

1886.

Located near Pactolus, 2 miles north of Grayson, the county town of Grayson county, Kentucky. Owners, J. M. Guffey & Co. Authority, F. H. Oliphant, manager.

Quicksand,	28 to	28
Slate, black,	30 "	58
SS., white and dark,	12 "	70
Slate, black,	10 "	80
Limestone, "Mountain limestone,"	20 "	100
Shale, sandy, dark-green,	100 "	200
" dark,	130 "	330
Slate, light-gray, with sand shells,	270 "	600
SS., dark, and shale,	50 "	650
" slate, and shells,	85 "	735
Slate, black,	22 "	757
SS., "Berea," 2′ to 5′ good (some oil and gas),	112 "	869
Slate, gray,	25 "	894
" red,	6 "	900
" black,	116 "	1016
" white,	5 "	1021
" black,	169 "	1190
" white,	20 "	1210
" black,	95 "	1305
" white,	118 "	1423
Limestone, "Niagara" (oil and gas),	2 "	1425
" " fine and coarse alternately,	55 "	1480

Strong flow of salt water at 1475′, filled up rapidly within 100′ of the top. Unproductive.

Choctaw, Indian Territory, Well.

1888.

Located on a branch of Clear Boggy River, 14 miles westerly from Atoka, Atoka county, Choctaw Nation.

Owners, National Oil Trust Co., of St. Louis. Record copied from the note book of the manager, the late Dr. H. W. Faucett.

Slate, blue (troubled with mud),	168 to	168
SS. and slate,	201 "	369
"	10 "	379
Slate,	45 "	424
SS.,	30 "	454
" and slate (small oil indications),	70 "	524
Sandy,	80 "	604
SS.,	10 "	614
Shale and hard sand,	45 "	659
Shells,	25 "	684
Slate and shells,	40 "	724
More sand than slate,	68 "	792
SS. (807′ casing),	29 "	821
" and slate (sand at 833′),	12 "	833
" (oil at 917′, tubed and tested, much salt water),	120 "	953
Slate,	20 "	973
" and sand,	50 "	1023
" clean,	35 "	1058
" and shells,	104 "	1162
SS. (salt water and good show of oil),	73 "	1235
Slate,	13 "	1248
Sand shells,	11 "	1259
Slate and shells,	18 "	1277
Sand shells and slate (900′ water in hole),	19 "	1296
SS. (1200′ water in hole, small oil show at 1302′),	12 "	1308
Slate,	27 "	1335
SS. (oil show at 1347′, oil and gas at 1391′),	79 "	1414

Still in sand and drilling, July 23, 1888.

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CONTOUR MAP
OF THE
CORNIFEROUS LIMESTONE
Showing the elevation of its upper surface
and its dip under portions of
NEW YORK, PENNSYLVANIA AND OHIO.

By J. E. Carll

Black Rock +823

Buffalo +600

Tonawanda +494

Firedmm +311

Guaranda +494

N E W Y O R K

ERIE 727

Meadville +1060

Titusville +1265

Bradford

Warren +1063

Oil City +1200

Franklin +1200

Tidioute +1265

Warren +1063

Corry +1600

Bradford +2800

Conewango Creek

Allegheny River

Kinzua Creek +2406

Kinzua +2406

Conewango +2900

Warren +1063

Oil City +1200

Franklin +1200

Tidioute +1265

Bradford +2800

Kinzua Creek +2406

Kinzua +2406

Conewango +2900

Allegheny River

Kinzua +2406

Conewango +2900

Allegheny River

Kinzua Creek +2406

SECOND GEOLOGICAL SURVEY OF PENNSYLVANIA
J. P. LESLEY, State Geologist

GENERALIZED VERTICAL SECTION
from the Top of the
UPPER BARREN COAL MEASURES
down to the
CORNIFEROUS LIMESTONE
TO SHOW THE VARIOUS OIL HORIZONS
OF CANADA, NEW YORK AND PENNSYLVANIA

Scale 100 ft

A reprint of Plate XI Report of Progress III with corrections
J. P. Lesley, State Geologist

Groups on Plate XI

	XII Limestone		
CHEMUNG GROUP No XVII	Upper Barren Coal Measures 'H'		No 1 H 600'
	Washington Upper Limestone		
WASHINGTON COUNTY GROUP No XVI	Upper Barren Coal Measures 'A'		No 1 A 350
	Waterdown Sd Waterdown Coal		
MONONGAHELA SERIES No XV	Upper Limestone	Upper Productive Coal Measures	No 2 475
	Pittsburgh Coal		
PITTSBURGH SERIES No XIV		Lower Barren Coal Measures	No 3 500'
	Redstone Sandstone		
	Freeport S S		
ALLEGHENY SERIES No XIII	Ferriferous Limestone	Lower Productive Coal Measures	No 4 400
	Homewood Sandstone		
PocoNo CONGLOMERATE No XII	Connoquenessing S S	Mountain Sands	No 5 375'
MAPLE CREEK No XI	Mercer Conglomerate Hundred foot Sands Sharon Conglomerate		
POCONO SERIES No X	Whole Coal Horizon	Crawford Shales	No 6 450'
	Venango Upper Oil Sand Venango Venango Lower Oil Sand		
PORTAGE DEVONIAN GENESEE No IX		Venango Butler Oil Group	No 7 350'
		Shales and thin Sandstones	No 8 300
	Warren Sand	Warren Group	
CHEMUNG No X	Bradford Sand	Bradford	
	Olean Lime Sand	Mc Kean Group	
MIDDLE DEVONIAN	Upper Sand Bradford Sand		
		Elk Group	
PORTAGE No IX			
GENESEE No X			
TULLY No XI		Devonian Slates & Shales	
HAMILTON No X			
LOWER DEVONIAN MARCELLUS No IX			
ONONDAGA No VIII		Corniferous Limestone	

Total 1,831 feet

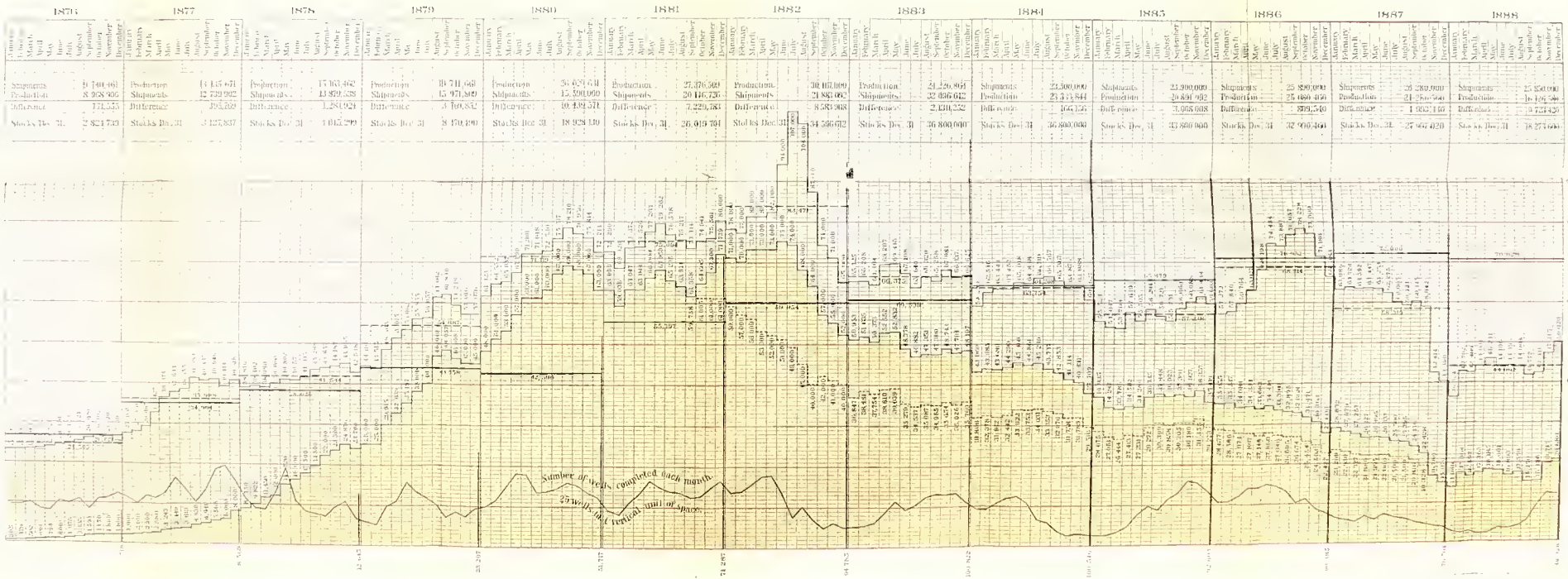
STATISTICAL CHART No. 3
OF THE

OIL REGIONS OF PENNSYLVANIA AND NEW YORK

SHOWING THE DAILY AVERAGES AND TOTALS OF PRODUCTION, SHIPMENTS AND STOCKS, AND THE NUMBER OF WELLS DRILLED FROM 1875 TO 1889,

BY

JOHN F. CARLL, Assistant Geologist in the Oil and Gas Regions



NOTES.

The Chart is a reprint of Chart No. 2, published in Annual Report of 1888. None of the original figures have been altered, but the net stocks on hand at the close of each year have been introduced, and the statistics for the years 1886, 1887 and 1888 are added.

The production, shipments and stocks of the Pennsylvania and New York oil regions are represented by scale, each space between the horizontal red lines standing for a daily average of 1000 barrels of oil.

The broken horizontal lines and figures show the average daily production during each year; the full horizontal lines, the average daily shipments; the vertical black lines in December of each year, the net stocks on hand at the close of the year—for example, on December 31st, 1888, the net stocks were 18,273,676, an average of 44,968 barrels for each day of the year.

The upper irregular line and figures show the average daily production of all the oil fields during each month of the years named, and the lower irregular line the production of the Bradford and Allegany fields. The dotted line commencing in 1881 indicates the production of the Bradford district after the Allegany district commenced to produce.

The white sand production is represented by the space between the two irregular solid lines, colored [ ], and the black sand production by the space remaining below, colored [ ]

White Sand 105,363,140
Black Sand 166,466,000
271 829,140

AUTHORITIES FOR DAILY AVERAGES.

1876 to 1881, inclusive; total production of all fields taken from *Stowell's Petroleum Reporter*, January, 1886; daily averages of Bradford and Allegany from the current monthly reports of same publication; the figures for 1880 having been corrected as explained in *Reporter* January, 1881.

1882.—This year the various reports were so conflicting that estimates were made and the results given in round numbers.

1883-'84-'85.—See table in *Petroleum Age*, January, 1886, page 1223.

1886-'87.—See table in *Petroleum Age*, December, 1887, page 1314

1888.—All the figures are from Pipe Line reports, and believed to be reliable.

Aggregate production from 1875 to 1889: Scale 10,000,000 barrels to the inch

SHIPMENTS AND STOCKS.

1876 to 1888, inclusive—same as on Chart No. 1, Annual Report, 1888.

1886-'87-'88—from Pipe Line reports.

NUMBER OF WELLS COMPLETED.

1876 to 1884, inclusive, from Derrick Hand Book of Petroleum, page 76, except the first seven months of 1876, which are from the *Petroleum Age*.

1885—from the *Oil City Derrick*.

1886-1887—from the *Petroleum Age*.

1888—from the *Oil City Derrick*.

The irregular line near bottom of chart represents the number of wells completed during the months named, each space between the horizontal lines standing for 25 wells.

	Months	Days	Total
1876	152	179	2,960
1877	1,393	647	4,956
1878	1,815	873	6,995
1879	2,847	1,021	9,730
1880	4,866	1,145	4,260
1881	3,241	1,107	4,348
1882	2,960	1,178	4,343
1883	3,586	1,203	4,789
1884	1,988	1,148	3,136
1885	1,591	1,159	2,750
1886	2,342	1,394	3,736
1887	1,364	1,139	2,503
1888	1,142	1,187	2,329
	34,625	14,855	49,480